United States Department of Agriculture

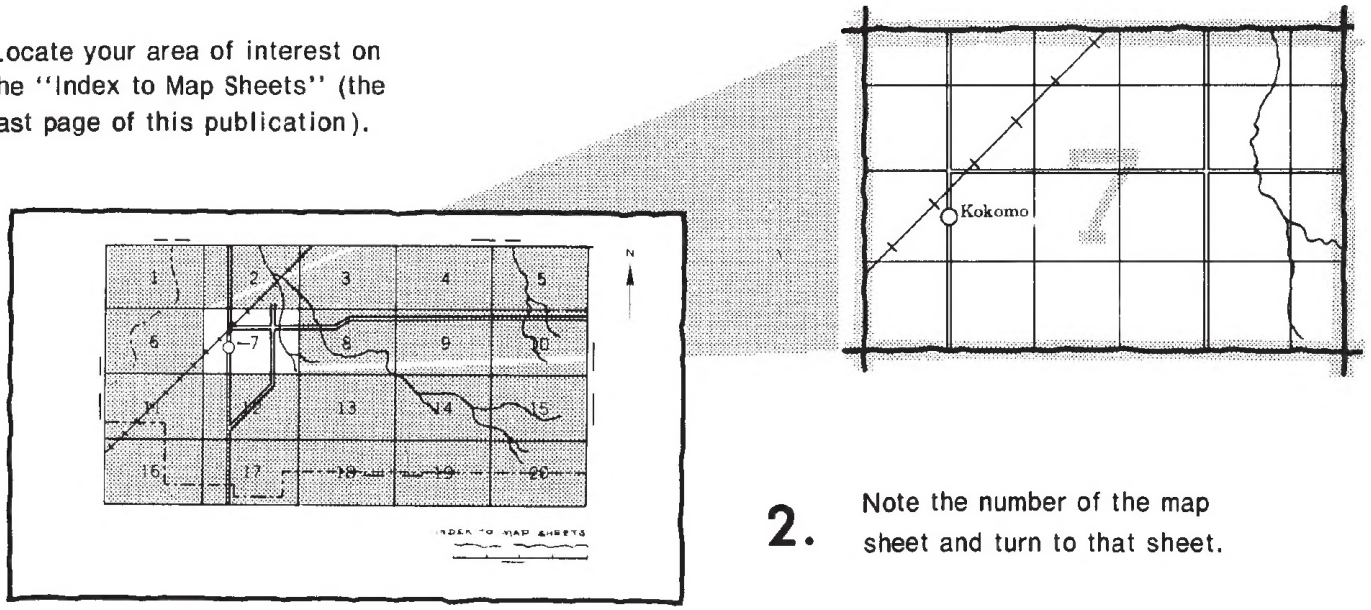
Soil Conservation Service

In cooperation with The Agricultural Experiment Station and the Cooperative Extension Service of the College of Agriculture The Pennsylvania State University; the Pennsylvania Department of Environmental Resources; and the Pennsylvania Department of Agriculture

Soil Survey of Butler County Pennsylvania

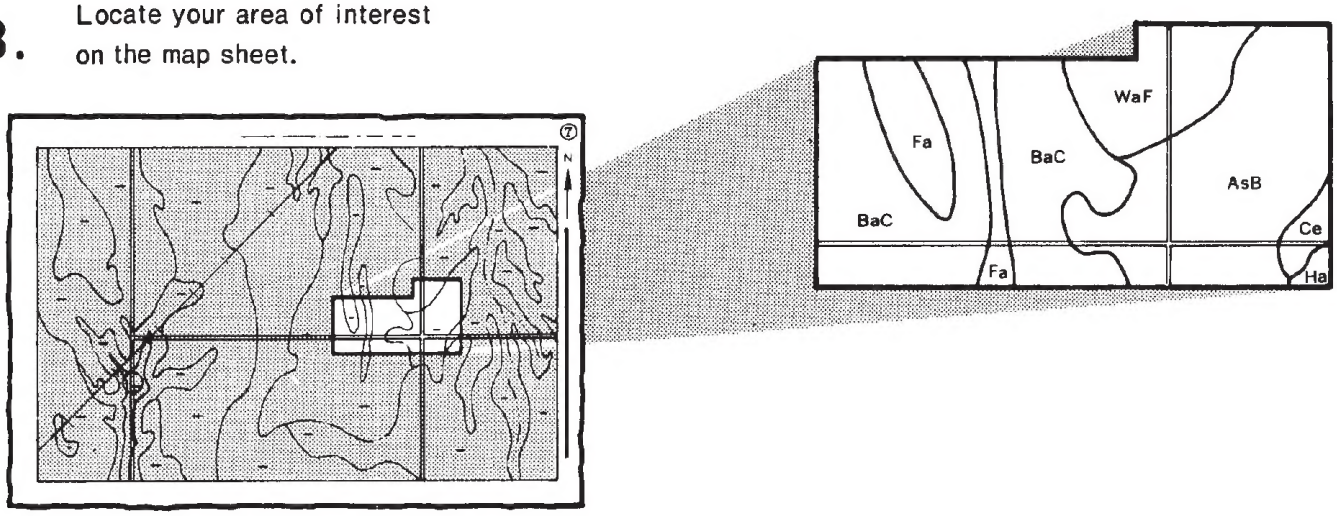
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

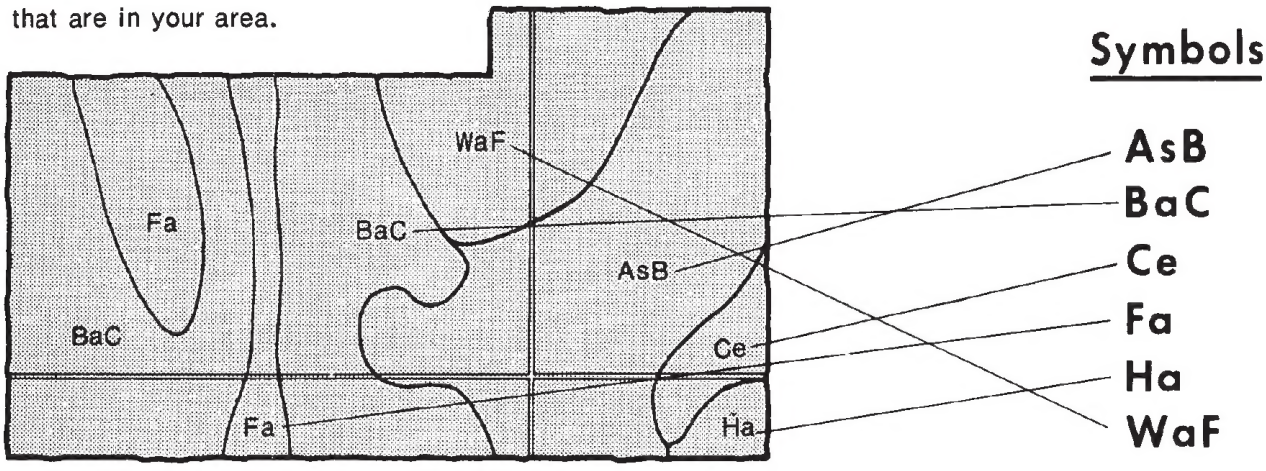


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

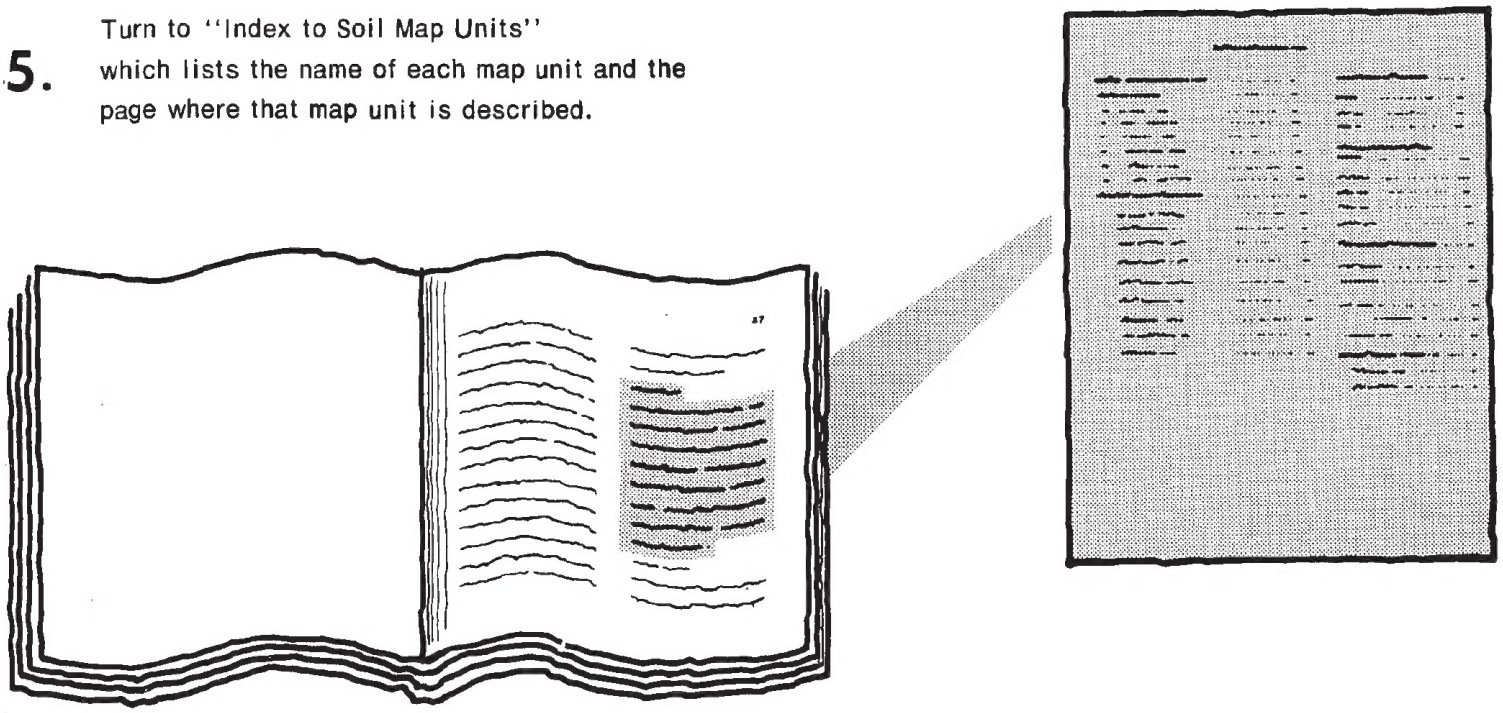


4. List the map unit symbols that are in your area.

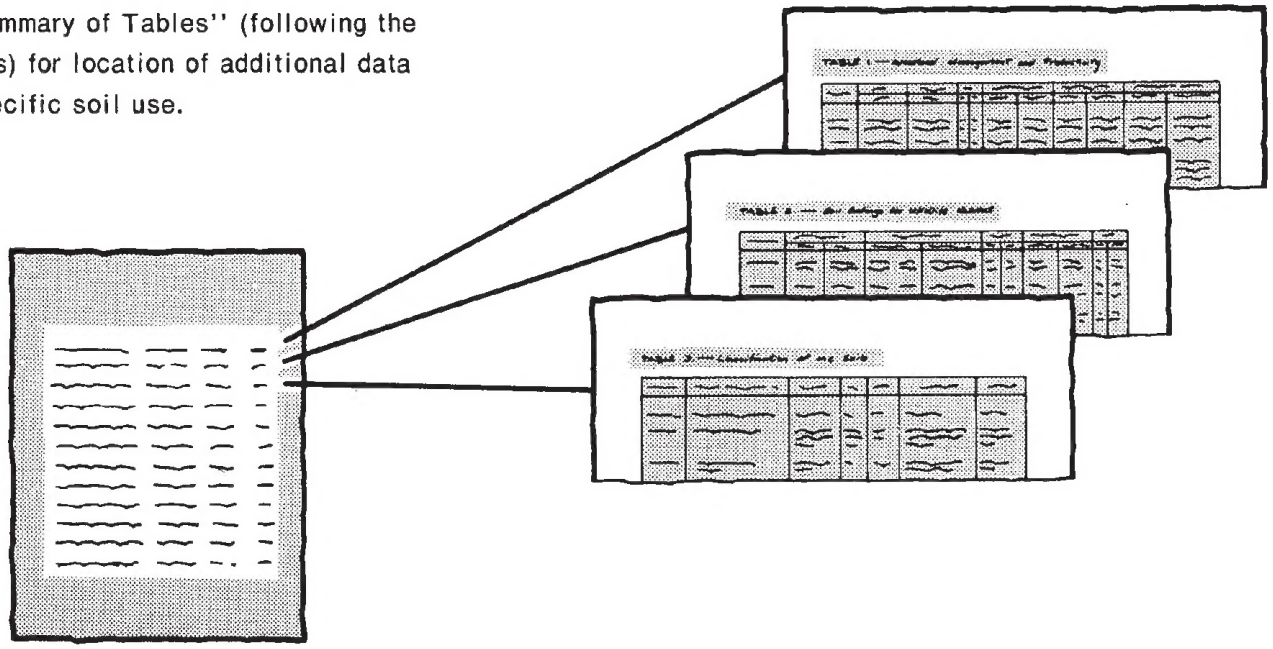


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service; the Agricultural Experiment Station and Cooperative Extension Service of the College of Agriculture, The Pennsylvania State University; the Pennsylvania Department of Environmental Resources; and the Pennsylvania Department of Agriculture. The U.S. Department of Housing and Urban Development and the Butler County Board of Commissioners provided financial assistance. The survey is part of the technical assistance furnished to the Butler County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Contour stripcropping helps to control erosion on Frenchtown silt loam, 3 to 8 percent slopes, and Gresham silt loam, 3 to 8 percent slopes.

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Soil Series

January 1989

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Butler County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

James H. Olson
State Conservationist
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Soil Survey of
Butler County, Pennsylvania

By Robert V. Smith, Soil Conservation Service

Fieldwork by Ivory L. Egypt, William R. Knight, and Robert V. Smith,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Agricultural Experiment Station
and the Cooperative Extension Service of the College of Agriculture,
The Pennsylvania State University;
the Pennsylvania Department of Environmental Resources;
and the Pennsylvania Department of Agriculture

BUTLER COUNTY is in the west-central part of Pennsylvania and has an area of 794 square miles, or 508,160 acres (fig. 1). About 50 percent of the land area is woodland, 22 percent is farmland, and 20 percent is urban, industrial, and community areas (*3*).

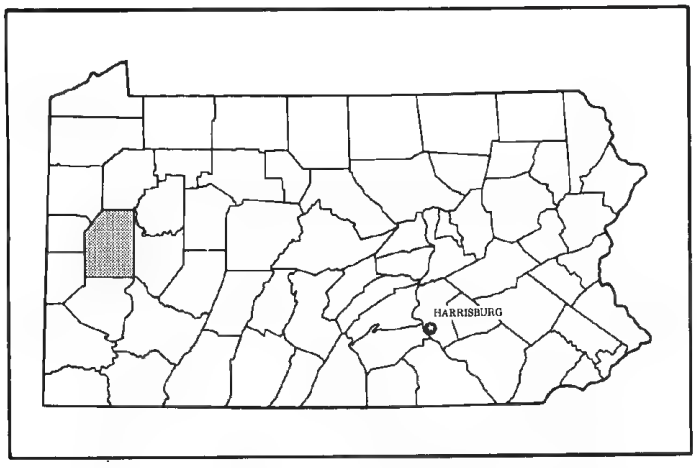

Figure 1.—Location of Butler County in Pennsylvania.

The county is in the central Allegheny Plateau of Pennsylvania. Only the extreme northwest part has been glaciated. The county is an undulating to hilly area with many drainageways and narrow valleys. The elevation ranges mainly from 1,000 to 1,400 feet above the sea level in the southern part of the county and mainly from 1,200 to 1,500 feet above sea level in the northern part. The lowest elevations are at the southeast corner (740 feet) and at the northeast corner (860 feet) where the Allegheny River touches the county. Some hilltops in the northeastern part are as much as 1,585 feet.

General Nature of the County

This section provides general information about some of the natural and cultural factors that affect land use in the county.

History and Development

William Penn received the royal charter of "Penn's Woods" from King Charles II of England in 1681. At that time the area that is now Butler County was part of the hunting grounds of the Iroquois Indians. During the period of early colonization this area was claimed by Pennsylvania, Virginia, France, and Great Britian. In

1753, George Washington crossed the county from south to north over the Venango Trail on his way to Fort LeBoeuf. He was carrying a message from Governor Dinwiddie of Virginia protesting the French encroachment on the land claimed by England. The English claim to this region was established during the French and Indian War. Missionaries, trappers, hunters, and explorers moved into the area by the Venango Trail and over the Kittanning Path, an Indian trail that crossed the county from the Allegheny River to Ohio. There was little settlement, however, until the late 1700s.

In 1784, the area was purchased from the Indians as part of the treaty of Fort Stanwix. A year later the land was set aside to be subdivided into tracts known as "Donation Lands" to be given to Revolutionary War veterans for their services. Settlement was further stimulated by the activities of the Harmony Society, a religious group that founded the town of Harmony on the banks of the Connoquenessing Creek. They established an intensive livestock and wine industry and exported large quantities of grain and wool cloth.

In 1800, Butler County was officially formed from part of Allegheny County. Between 1800 and 1870, much of the wilderness of the county was slowly replaced by cleared fields, houses, and towns. Roads began to reach into all parts of the county.

The discovery of oil in the county caused rapid development from 1870 to 1890. The town of Petrolia, for example, grew almost overnight from a settlement of three houses to a population of 5,000 at the height of the oil boom. The population of some towns decreased as the supplies of oil decreased, but many towns continued to develop after the peak oil-drilling. The oil production in the county in 1980 was 69,969 barrels, sixth in the State, from 1,116 wells (*4*). The need for fuel for heat and to drive the pumping engines at the oil wells gave rise to the natural gas industry in the county. Later, the natural gas was piped to homes and other industries.

In 1980, according to the U.S. Bureau of the Census, the population of Butler County was 147,912. About 30 percent of that is urban. The population of the county has increased by about 29 percent since 1960 and by about 15 percent since 1970. Butler, the county seat and only city in the county, had a population of 17,026 in 1980, a decrease of about 9 percent since 1970. Between 1970 and 1980, all of the townships in the county increased in population, and Cranberry and Slippery Rock Townships more than doubled in population.

Agriculture and Industry

When Butler County was originally cleared for settlement, farming was largely of the subsistence type. The forests provided fuel, lumber, tannin, and charcoal. Natural deposits of coal, limestone, clay, and sand were available as raw material. The soils and climate were suitable for wheat, rye, corn, buckwheat, flax, and grass. Livestock provided food, leather, and wool. The larger streams powered mills and provided transportation.

The early industries were flour mills, sawmills, tanneries, and ceramic and iron works. The proximity of the county to the rapidly developing iron industry of the Pittsburgh area and to the Ohio and Allegheny River Valleys caused the expansion and development of several industries in the county. The oil boom of the 1870s gave rise to the oil-refining industry and related chemical industries.

Today, the primary-metal industry is dominant in the county. Fabricated metal products are second. The other major industries are in the fields of transportation equipment; nonelectrical machinery; stone, glass, clay, and concrete products; and petroleum refineries, chemicals, and related products (*4*).

In 1979, Butler County ranked 16th in the State in agricultural sales. In 1980, it ranked fifth in the production of oats (*4*). The principal agricultural products are dairy products, livestock, poultry and eggs, corn, oats, wheat, hay, potatoes, mushrooms, honey, apples, horticultural specialties, greenhouse crops, and maple syrup.

Mineral Resources

Bituminous coal underlies most of the county, and strip mining is the common method of extracting the coal. Earlier, it was obtained by deep mining and small-drift or shaft mining into the hillsides. The principal productive veins of coal are the Clarion, Brookville, Middle Kittanning, Upper Freeport, and Lower Freeport beds. In 1980, their yield was 2,121,443 tons of bituminous coal, making Butler County 12th in the State in coal production (*4*).

Vanport limestone is mined commercially in several places in the county. Deep mining of the limestone was common, but most limestone is obtained by stripping the overburden to expose a limestone vein 1 to 25 feet thick. The main limestone-mining operations are at Harrisville, Slippery Rock, Branchton, Portersville, and West Winfield. The limestone is used mostly for crushed stone for road building and general construction, pulverized agricultural limestone, portland cement, and the iron industry.

Sand and gravel are obtained mainly from glacial outwash deposits, such as eskers, kames, and kame terraces. The main pits are in the vicinity of Slippery Rock, West Liberty, and Portersville. The sand and gravel are used primarily for concrete structures, for masonry mortar, fill, and rip-rap, and for septic fields.

Shale and clay are abundant in the county, but only a few pits have been opened, mainly for making brick and ceramics and for fill. Only a few sandstone quarries have been opened, and none are active. The sandstone was

used for buildings, foundations, masonry work, and sand for polishing plate glass.

Physiography and Geology

The dominant physiography of Butler County, except for the northwest corner, is rolling and hilly and consists of broad to narrow ridgetops and many steep-walled valleys. The Connoquenessing Creek has carved a deep, broad valley across the south-central part of the survey area. Broad, undulating areas are near Saxonburg, Connoquenessing, and Prospect. The physiography of the northwest part of the survey area is smooth to rolling and consists of many low rounded hills and ridges. Poorly drained depressions are scattered throughout this area. The valleys occupied by Slippery Rock and Wolf Creeks are steep sided.

About 300 million years ago, layers of sandy, silty, clayey, and limy sediments were laid down on this part of the continent in freshwater inland seas (*5*). Organic material accumulated in vast swamps during various stages of this deposition. Over great periods, the area was subsequently raised from sea level to a position at or above its present level. The extreme pressures created during this uplifting and the weight of overlying sediments consolidated these layers of sediment into sandstone, siltstone, shale, and limestone. The beds of decayed organic material formed coal. This area in Pennsylvania became what is known as the Allegheny Plateau. Millions of years of additional minor uplifting and subsiding, geologic erosion, and stream cutting changed the nearly level surface to one that is highly dissected and rolling and hilly. The survey area is part of this old plateau.

The bedrock underlying Butler County was formed during the Pennsylvanian Age, 280 million to 310 million years ago (*5*). The bedrock is divided into three major groups based upon the age of the rocks. They are, from oldest to youngest, the Pottsville, Allegheny, and Conemaugh Groups (*7*).

The Pottsville Group underlies glacial and alluvial deposits in Wolf and Slippery Rock Creeks. It is exposed in the steep valley walls along these waterways and their tributaries and in the northeastern part of the county along Bear Creek and the Allegheny River. The Pottsville group consists dominantly of massive sandstone interbedded with shale and siltstone and thin lenses of coal. The soils of the Hazleton-Buchanan-Gilpin general soil map unit are on most of the steep, stony valley walls. The soils of the Atkins-Canadice-Caneadea and Riverhead-Braceville-Wheeling general soil map units are in the valley bottoms in the western part (*8*).

The Allegheny Group is extensive. It underlies most of the northern third of the county north of Portersville, Muddy Creek, Hooker, and Karns City. To the south it is in valley bottoms and side slopes along Connoquenessing Creek and its major tributaries and Buffalo Creek and Rough Run. The Allegheny Group consists of cyclic sequences of sandstone, siltstone, shale, and coal and a major limestone strata in the lower part. Most of the commercially available coal and limestone are in this group. The major coals are the Brookville, Clarion, Kittanning, and Freeport formations. The Vanport limestone, though not in all places, averages about 10 feet in thickness and in places is as thick as 25 feet. The major soils are in the Hazleton-Buchanan-Gilpin, Udorthents-Wharton-Hazleton, and Hazleton-Gilpin-Wharton general soil map units (*8*).

The Conemaugh Group is at the surface throughout most of the southern two-thirds of the county. It consists of recurring sequences of sandstone, red and gray shale and siltstone, and thin strata of limestone and coal. The rocks of the Conemaugh Group, especially the red shale, locally known as the Pittsburgh Red Beds, are the most landslide-prone in the county.

During the period mainly from 75,000 to 23,000 years ago, the northwest part of Butler County was covered by three major glaciers. These glaciers modified the surface features, which until that time were much like the rest of the survey area (*9*). As the glaciers moved south, they scoured and smoothed the hilltops and filled the many valleys. Vast quantities of sand, silt, clay, gravel, cobblestones, and boulders were pushed ahead of the glaciers or were incorporated into the advancing ice. Part of the material was trapped and overridden by the ice and became compacted till. As the glaciers retreated, or melted, water carried more material from the ice front and deposited it in layers or pockets of sorted material known as outwash. Sandy and gravelly outwash was deposited in the stream valleys and along the valley walls. Silt and clay were deposited in glacial lakes.

The northwest part of the county is mantled with glacial till, sandy and gravelly outwash, and clayey lacustrine material. These glacial deposits range in thickness from a very thin mantle to more than 50 feet. Most of the soils in the northwest corner of the survey area formed in glacial deposits overlying bedrock. Many physical and chemical properties of the soils were inherited from the glacial material. Soils that formed in glacial till are in the Gresham-Titusville-Frenchtown general soil map unit. They are throughout most of the northwest part of the survey area. Soils that formed in glacial outwash on kames, kame terraces, eskers, and valley trains are in the Riverhead-Braceville-Wheeling general soil map unit. The major areas of this association are in the vicinity of Harrisville and in the lower valley of Slippery Rock Creek. The dominant soils that formed in the clayey and silty sediments deposited in glacial lakes are in the Atkins-Canadice-Caneadea general soil map unit, most of which is in valleys of Slippery Rock Creek and its tributaries.

The oldest glacial activity in the county probably occurred more than 75,000 years ago during the Illinoian period (*6*). This glacier advanced from the northwest into

the county to Portersville, Stone House, Bovard, and 4 miles east of Harrisville. Deposits from this ice advance are known as Mapledale Till (*6*). They are in a belt less than 1 mile to 5 miles wide and dotted with sparse patches of thin till, surface gravel, and boulders.

Two major periods of glacial advance, Titusville drift and Kent drift, occurred during the Wisconsin glaciation. Titusville drift was deposited about 40,000 years ago in a belt 1 to 3 miles wide. It extends to about 2 miles east of Harrisville to Forestville and to 2 miles north of Portersville. The thickness of the Titusville Till ranges from a very thin mantle to 24 feet but is commonly 5 to 10 feet. Kent drift was deposited about 23,000 years ago. It extends from the northwest border of the county to Harrisville, Slippery Rock, and West Liberty. Kent Till mainly ranges from 5 to 10 feet in thickness and overlies Titusville Till.

An extensive system of lakes was formed in front of the advancing glaciers. Two of those lakes, Lake Edmond and Lake Watts, developed in Butler County (*6*). Lake Edmond was in the valleys now drained by Slippery Rock Creek and its tributaries, and Lake Watts was in the area now drained by Muddy Creek. Both of these lakes were nearly filled with deposits from the glaciers and the surrounding land masses. Lake Arthur, in Moraine State Park, now occupies a major part of the area once covered by Lake Watts.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Winters in Butler County are cold and snowy at the higher elevations. Winters in the valleys are also frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on the mountain slopes and very warm in the valleys. Rainfall is evenly distributed throughout the year, but it is heavier on the windward, west-facing slopes than in the valleys. The normal annual precipitation generally is adequate for crops, but in some areas, particularly at the higher elevations, the summer temperature is too low and the growing season is too short.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Slippery Rock in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred at Slippery Rock on February 12, 1979, is -21 degrees. In summer the average temperature is 68 degrees, and the average daily maximum temperature is 80 degrees. The highest recorded temperature, which occurred at Slippery Rock on June 17, 1952, is 99 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 46.6 inches. Of this, 23 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 3.8 inches at Slippery Rock on October 16, 1954. Thunderstorms occur on about 36 days each year, and most occur in summer.

The average seasonal snowfall is 47 inches. The greatest snow depth at any one time during the period of record was 40 inches. On the average, 28 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 55 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the west-southwest. Average windspeed is highest, 11 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material has few or no roots or other living organisms and has been changed very little by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables

the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows the general soil map units in this survey area. Each unit has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, a unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the boundaries of the map do not match those of the general soil maps of adjacent counties. The differences exist because of differences in legend design, changes in soil classification, and different proportions of soils in the adjacent counties.

Soil Descriptions

Very Deep Soils Formed in Glacial Material

The two map units in this group make up about 6 percent of the total land area of the county. They are on smooth to rolling uplands, depressions, and drainageways in the northwest part of the county. The soils formed in glacial till and outwash. They range from nearly level to steep and from well drained to poorly drained.

These units are used mainly for farmland. Some ridges and lowlands are in woodland. The communities of Slippery Rock, Harrisville, and West Liberty are in this group, and suburban development is active along the major roads in the area.

These units have fair or good potential for farmland and good potential for woodland and wildlife habitat. They have fair to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, slope, moderate available water capacity, and rapid permeability in the substratum.

1. Gresham-Titusville-Frenchtown

Nearly level to steep, very deep, moderately well drained to poorly drained soils formed in glacial till

This map unit is in the northwest part of the county. The unit is on smooth to rolling uplands and in depressions and drainageways, all on till plains and moraines (fig. 2).

This unit makes up about 5 percent of the total land area of the county. The unit is about 40 percent Gresham soils, 35 percent Titusville soils, 10 percent Frenchtown soils, and 15 percent soils of minor extent.

The Gresham soils are somewhat poorly drained. They have a firm layer, called a fragipan, and have a seasonal high water table for long periods during wet seasons. The Gresham soils are on nearly level to strongly sloping, smooth and undulating uplands.

The Titusville soils are moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. The Titusville soils are on gently sloping to steep, smooth to rolling uplands.

The Frenchtown soils are poorly drained. They have a firm layer, called a fragipan, and have a high water table during a major portion of the year. Ponding occurs in depressions and minor drainageways during wet seasons and following intensive rainfall. The Frenchtown soils are on nearly level and gently sloping, smooth lowlands, depressions, foot slopes, and small drainageways.

Of minor extent on uplands in this unit are well drained Riverhead, Wheeling, Hazleton, and Gilpin soils; moderately well drained Braceville soils; and somewhat poorly drained Cavode soils. Somewhat poorly drained Caneadea soils, somewhat poorly drained and poorly drained Fredon soils, and poorly drained Canadice soils are of minor extent in depressions and lowlands. Poorly drained Atkins soils are on most flood plains. Udorthents are throughout the unit.

Most areas of this unit are used for farmland. Beef, dairy, and grain farming are the main farm enterprises. Corn, small grain, hay, and pasture are the major crops. Artificial drainage is usually needed to remove excess water on farmland. Many ridges and poorly drained areas are in woodland. Some of the land that was farmed is reverting to brush and woodland. Urban development is expanding near Slippery Rock and Harrisville and along the major roads in the area.

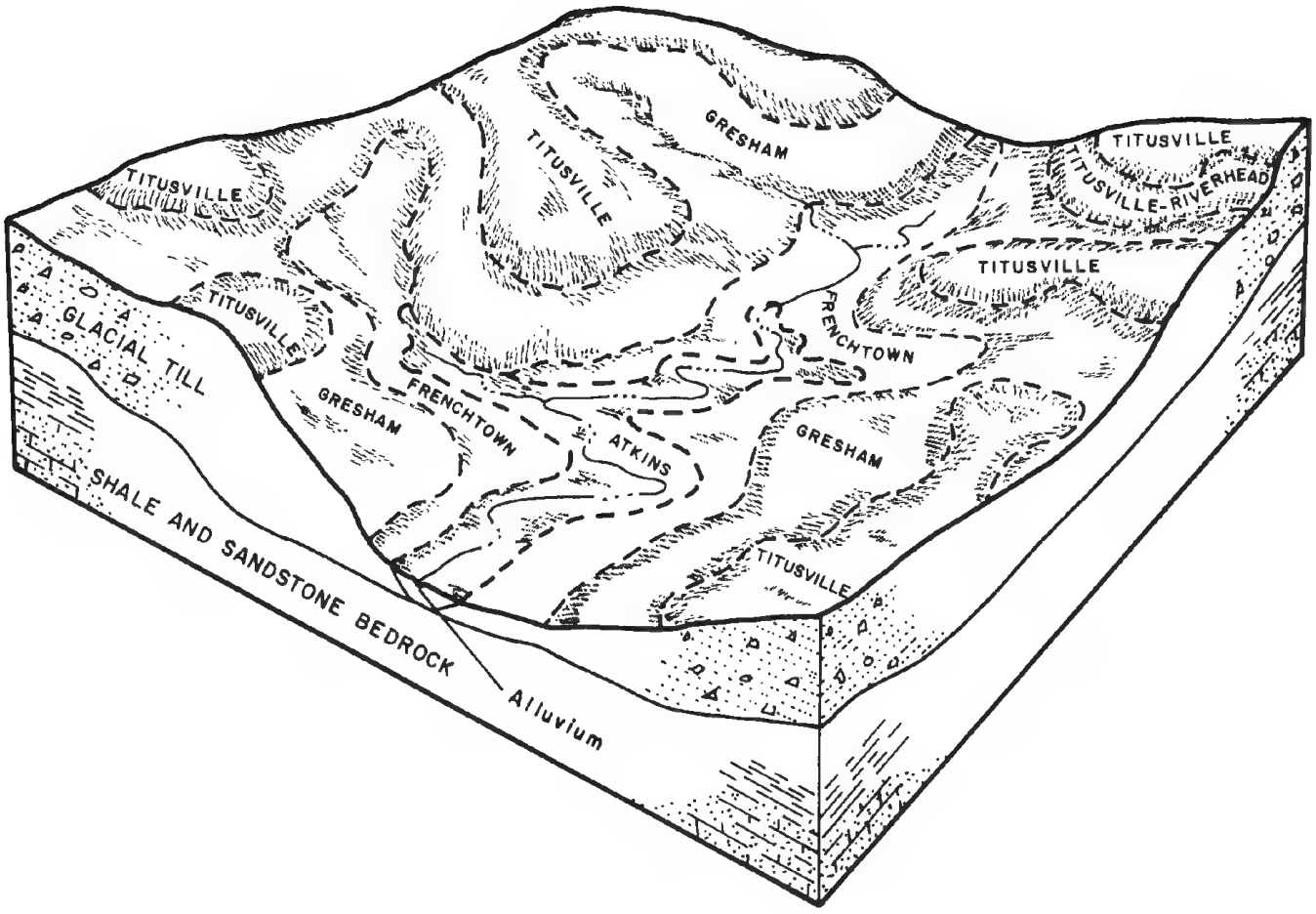

Figure 2.—Typical pattern of soils and underlying material in the Gresham-Titusville-Frenchtown unit.

This unit has good or fair potential for farmland and good potential for woodland and wildlife habitat. It has fair to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, and slope.

2. Riverhead-Braceville-Wheeling

Nearly level to steep, very deep, well drained and moderately well drained soils formed in glacial outwash

This map unit is in the northwest part of the county. The unit is along Slippery Rock, Wolf, and Muddy Creeks and in the vicinity of Harrisville and West Liberty. It is on smooth to rolling uplands and drainageways on outwash plains, kames, terraces, and eskers (fig. 3).

This unit makes up about 1 percent of the total land area of the county. The unit is about 30 percent Riverhead soils, 30 percent Braceville soils, 15 percent Wheeling soils, and 25 percent soils of minor extent.

The Riverhead soils are well drained. They are sandy soils underlain by stratified sand and gravel and are on gently sloping to steep, smooth to hummocky outwash plains, kames, and eskers.

The Braceville soils are moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. They are loamy and sandy soils underlain by stratified sand and gravel and are on nearly level to strongly sloping, smooth and undulating uplands.

The Wheeling soils are well drained. They are loamy soils underlain by stratified sand and gravel and are on nearly level and gently sloping, smooth and undulating uplands.

The dominant minor soils in this unit are somewhat poorly drained and poorly drained Fredon soils. Other minor soils are moderately well drained Titusville soils, somewhat poorly drained Gresham and Caneadea soils,

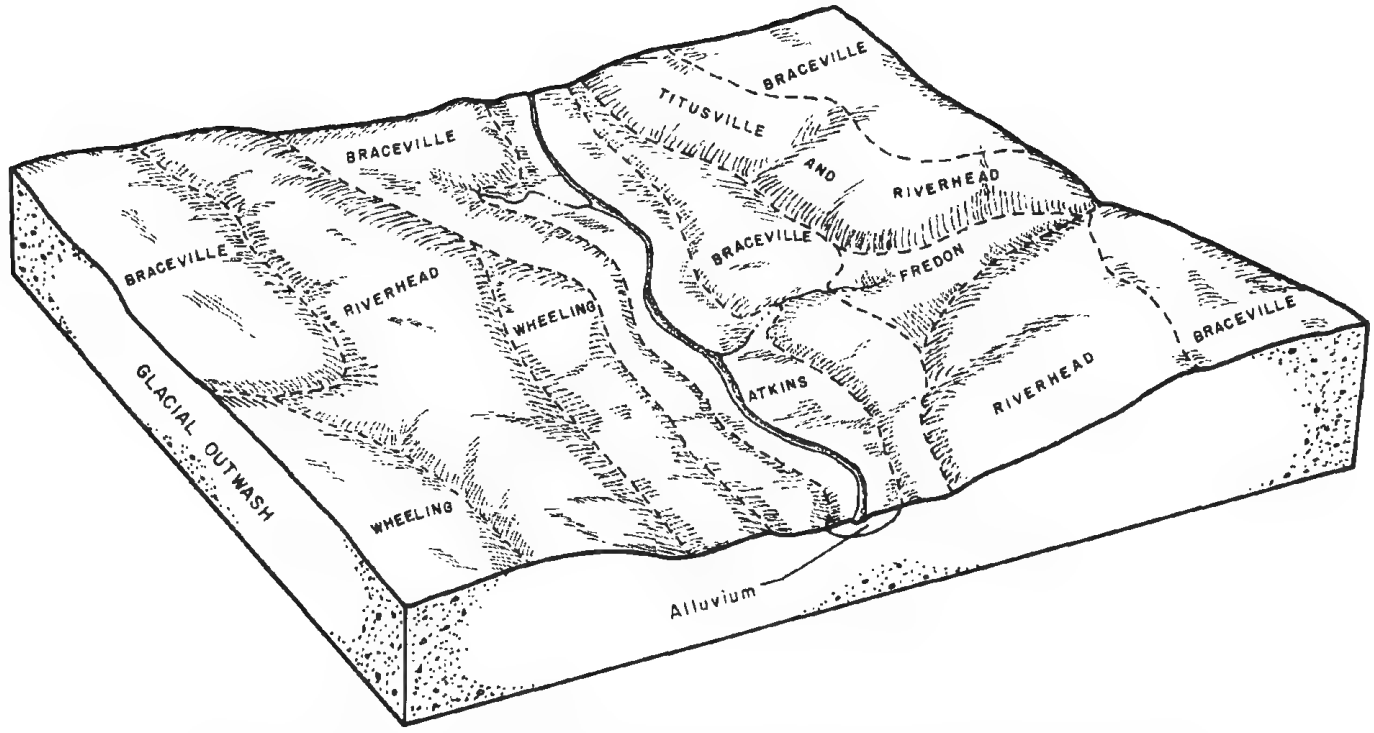

Figure 3.—Typical pattern of soils and underlying material in the Riverhead-Braceville-Wheeling unit.

and poorly drained Canadice and Frenchtown soils. Well drained Pope soils, moderately well drained Philo soils, and poorly drained Atkins soils are on flood plains. Sand and gravel pits are common in this unit.

Most areas of this unit are used for farmland. Some ridges, steep areas, and lowlands are in woodland. Some areas that were farmed are reverting to brush and woodland. Beef, dairy, and grain farming are the main farm enterprises. Corn, small grains, hay, and pasture are the major crops. Crop yields on the Riverhead soils are reduced in dry years because of moderate available water capacity.

This unit has good potential for farmland, woodland, and wildlife habitat. It has good to poor potential for urban uses. It is a good source of sand and gravel. The major limitations of the soils are slope, available water capacity, seasonal wetness, slow permeability, and rapid permeability in the substratum.

Very Deep Soils Formed in Alluvium and Lacustrine Sediments

The two map units in this group make up about 4 percent of the total land area of the county. They are on flood plains, lowlands, and terraces mainly along Connoquenessing and Slippery Rock Creeks and their tributaries. The soils range from nearly level to moderately steep and from moderately well drained to poorly drained.

These units are used mostly for farmland and woodland. Many lowlands are in brush and wetland grasses. The communities of Zelienople, Harmony, West Liberty, and Boyers are in this group.

These units have fair to poor potential for farmland and good to fair potential for woodland and wildlife habitat. They have fair to poor potential for urban uses. The major limitations of the soils are frequent flooding, wetness, and slow permeability.

3. Atkins-Canadice-Caneadea

Nearly level to moderately steep, very deep, poorly drained and somewhat poorly drained soils formed in alluvium and lacustrine sediments

This map unit is in areas on flood plains, lowlands, and dissected low-lying benches in the northern half of the county. Most areas are near Slippery Rock Creek and its tributaries and along Muddy Creek.

This unit makes up about 3 percent of the total land area of the county. The unit is about 40 percent Atkins soils, 15 percent Canadice soils, 15 percent Caneadea soils, and 30 percent soils of minor extent.

The Atkins soils are poorly drained. They have a high water table during a major portion of the year and are frequently flooded. They are on nearly level flood plains.

The Canadice soils are poorly drained. They have a clayey subsoil and substratum and have a high water table most of the year. Runoff is slow, and ponding is common during wet seasons and following periods of heavy rainfall. The Canadice soils are on nearly level lowlands and in nearly level shallow depressions.

The Caneadea soils are somewhat poorly drained. They have a clayey subsoil and substratum and have a seasonal high water table for long periods during wet seasons. The Caneadea soils are dominantly on nearly level and gently sloping terraced benches and lowlands, but some dissected benches are moderately steep.

Of minor extent in this unit are poorly drained Frenchtown, Brinkerton, and Andover soils; somewhat poorly drained and poorly drained Fredon soils; and moderately well drained Braceville and Buchanan soils. Well drained Riverhead soils are on small mounds and ridges.

Most areas of this unit are in woodland, brush, and wetland grasses. A few areas are used for farmland. Artificial drainage is needed to remove excess surface and ground water from farmland.

This unit has fair to poor potential for farmland and good or fair potential for woodland and wildlife habitat. It has poor potential for urban uses. The major limitations of the soils are frequent flooding, wetness, slow permeability, and instability.

4. Monongahela-Atkins-Caneadea

Nearly level to sloping, very deep, moderately well drained to poorly drained soils formed in alluvium and slackwater or lacustrine sediment

The map unit is along Connoquenessing Creek and its tributaries and Brush Creek. It is on smooth to rolling terraces, flood plains, and small areas on adjacent uplands and foot slopes.

This unit makes up about 1 percent of the total land area of the county. The unit is about 30 percent Monongahela soils, 30 percent Atkins soils, 15 percent Caneadea soils, and 25 percent soils of minor extent.

The Monongahela soils are moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. The soils are on gently sloping and strongly sloping terraces.

The Atkins soils are poorly drained. They have a high water table during a major part of the year and are frequently flooded. They are on nearly level flood plains.

The Caneadea soils are somewhat poorly drained. They have a clayey subsoil and substratum and have a seasonal high water table for long periods during wet seasons. The soils are on dominantly nearly level and gently sloping terraces.

Of minor extent in this unit are well drained Riverhead and Wheeling soils, moderately well drained Braceville and Ernest soils, somewhat poorly drained and poorly drained Fredon soils, and poorly drained Canadice and Brinkerton soils. Well drained Pope soils and moderately well drained Philo soils are on flood plains near the Atkins soils. Udorthents are in a few areas.

Most areas of this unit are used for farmland and woodland. Some areas near Zelienople are used for urban land. Beef and dairy farming are the major farm enterprises. Corn, small grain, hay, and pasture are the major crops. Camps and summer cottages are common along Connoquenessing Creek.

This unit has fair potential for farmland and good potential for woodland and wildlife habitat. It has fair to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, slope, and frequent flooding.

Moderately Deep to Very Deep Soils Formed Dominantly in Residual Material

The seven map units in this group make up about 90 percent of total land area in the county. They are on uplands, foot slopes, and lowlands throughout all but the northwest part of the county. Most of the soils formed in materials weathered from sandstone, siltstone, and shale. The Udorthents formed during strip mining of coal and limestone. The soils range from nearly level to very steep and from excessively drained to poorly drained.

These units are used mainly for farmland and woodland. Many areas that were farmed are reverting to brush and woodland. A large portion of the Udorthents-Wharton-Hazleton unit is barren or only sparsely vegetated. Urban, industrial, and commercial developments are expanding near Butler and other towns in the area and along most of the major roads.

These units have dominantly good or fair potential for farmland, and good potential for woodland and wildlife habitat. The Udorthents-Wharton-Hazleton unit has poor potential for farmland and fair to poor potential for woodland and wildlife habitats. The Hazleton-Buchanan-Gilpin unit is generally unsuited to farmland because of steep slopes or stones on the surface. The units in this group have good to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, slope, depth to bedrock, clayey soil material, low available water capacity, and many small and large stones on the surface.

5. Hazleton-Cookport-Buchanan

Nearly level to steep, deep and very deep, well drained and moderately well drained soils formed in material weathered dominantly from sandstone

This map unit is throughout all but the northwest part of the county. The major areas are in the vicinity of Connoquenessing and Prospect, on uplands near Buffalo Creek and Bear Creek, and near branches of Slippery Rock Creek. The unit is on smooth or rolling, broad and narrow ridgetops, side slopes, and benches (fig. 4).

This unit makes up about 9 percent of the total land area of the county. The unit is about 40 percent Hazleton soils, 20 percent Cookport soils, 15 percent Buchanan soils, and 25 percent soils of minor extent.

The Hazleton soils are deep and well drained. They are channery throughout and are underlain by sandstone bedrock at a depth of more than 40 inches. These soils are on gently sloping to steep uplands.

The Cookport soils are deep and moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. They are underlain by sandstone bedrock at a depth of more than 40 inches. These soils are on nearly level to moderately steep uplands.

The Buchanan soils are very deep and moderately well drained. They have a firm layer, called a fragipan, and have a high water table during wet seasons. They are underlain by bedrock at a depth of more than 60 inches. These soils are in gently sloping or strongly sloping depressions and minor drainageways and on foot slopes and benches.

Of minor extent on uplands in this unit are well drained Clymer and Gilpin soils; moderately well drained

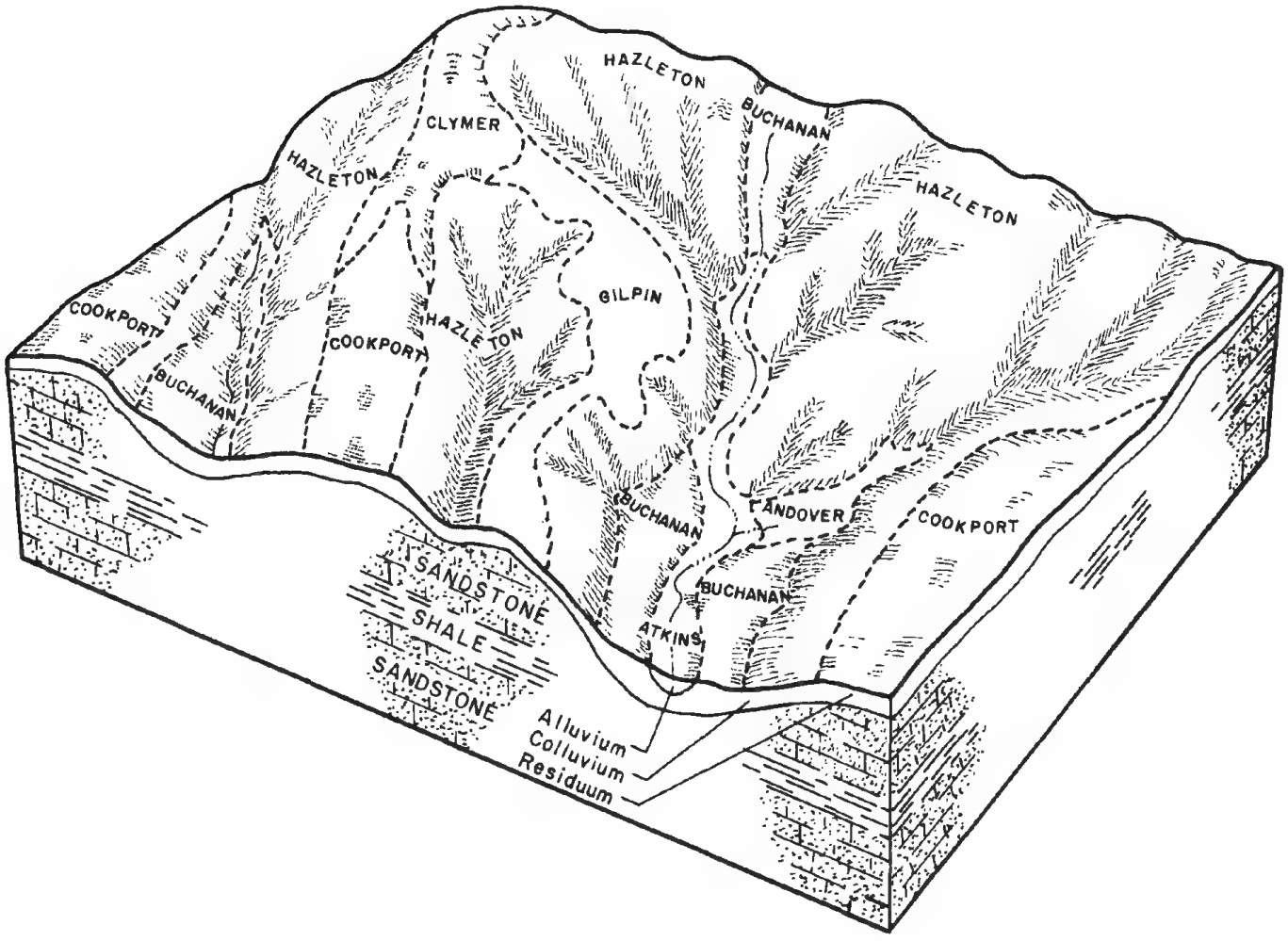

Figure 4.—Typical pattern of soils and underlying material in the Hazleton-Cookport-Buchanan unit.

Wharton, Tilsit, and Ernest soils; and somewhat poorly drained Cavode soils. Poorly drained Andover and Brinkerton soils are in depressions and on lowlands. Poorly drained Atkins soils are on most flood plains. Udorthents are throughout the unit.

Most areas of this unit are used for farmland and woodland. Many areas that were farmed are reverting to brush and woodland. Dairy farming, potato farming, and orchards are the major farm enterprises. Corn, potatoes, small grains, apples, and hay and pasture are the major crops. Suburban development is active in the Connoquenessing area.

This unit has good potential for farmland, woodland, and wildlife habitat. It has good to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, and slope.

6. Hazleton-Gilpin-Wharton

Nearly level to steep, moderately deep and deep, well drained and moderately well drained soils formed in material weathered dominantly from sandstone and siltstone

This map unit is throughout all but the northwest part of the county. The unit is undulating to rolling on uplands, in depressions, and in drainageways.

This unit makes up about 15 percent of the total land area of the county. The unit is about 30 percent Hazleton soils, 20 percent Gilpin soils, 15 percent Wharton soils, and 35 percent soils of minor extent.

The Hazleton soils are deep and well drained. They are channery throughout and are underlain by sandstone bedrock at a depth of more than 40 inches. These Hazleton soils are on gently sloping to steep uplands.

The Gilpin soils are moderately deep and well drained. They are channery throughout and are underlain by siltstone or shale bedrock at a depth of 20 to 40 inches. These Gilpin soils are dominantly on gently sloping to steep uplands.

The Wharton soils are deep and moderately well drained. They have a seasonal high water table during wet seasons. They are underlain by shale and siltstone bedrock at a depth of more than 40 inches. These Wharton soils are on nearly level to moderately steep uplands.

Of minor extent on uplands in this unit are well drained Clymer and Weikert soils; moderately well drained Tilsit, Cookport, Ernest, and Buchanan soils; and somewhat poorly drained Cavode soils. Poorly drained Andover and Brinkerton soils are in depressions and lowlands. Poorly drained Atkins soils are on most flood plains. Udorthents are throughout the unit.

Most areas of this unit are used for farmland and woodland. Many areas that were farmed are reverting to brush and woodland. Raising beef, potato farming, and dairy farming are the major farm enterprises. Corn, potatoes, small grains, and hay and pasture are the major crops. Urban and industrial developments are in the vicinity of Karns City, Petrolia, East Butler, Chicora, and Eau Claire.

This unit has good potential for farmland, woodland, and wildlife habitat. It has good to poor potential for urban uses. The major limitations are seasonal wetness, slow permeability, depth to bedrock, and slope.

7. Gilpin-Wharton

Gently sloping to very steep, moderately deep and deep, well drained and moderately well drained soils formed in material weathered dominantly from siltstone and shale

This map unit is throughout all but the northwest part of the county. The unit is on undulating to hilly uplands and associated drainageways (fig. 5).

This unit makes up about 24 percent of the total land area of the county. The unit is about 30 percent Gilpin soils, 15 percent Wharton soils, and 55 percent soils of minor extent.

The Gilpin soils are moderately deep and well drained. They are channery throughout and are underlain by siltstone and shale at a depth of 20 to 40 inches. These soils are on gently sloping to very steep uplands.

The Wharton soils are deep and moderately well drained. They have a seasonal high water table during wet seasons. They are underlain by siltstone and shale bedrock at a depth of more than 40 inches. These Wharton soils are dominantly on gently sloping to moderately steep uplands.

The dominant minor soils on uplands in this unit are well drained Hazleton and Weikert soils and somewhat poorly drained Cavode soils. Moderately well drained Ernest soils and poorly drained Brinkerton soils are in depressions, on foot slopes, and in lowlands. Poorly drained Atkins soils are on most flood plains. Udorthents are throughout the unit. Of lesser extent are Upshur, Vandergrift, Cookport, Buchanan, and Tilsit soils.

Most areas of this unit are used for farmland, woodland, and urban development. Many areas that were farmed are reverting to brush and woodland. Dairy farming, raising beef or poultry, and grain farming are the major farm enterprises. Corn, small grains, and hay and pasture are the major crops. Urban and industrial developments are at Zelienople, Butler, Chicora, West Sunbury, and Bruin and along major roads.

This unit has good or fair potential for farmland and good potential for woodland and wildlife habitat. It has good to poor potential for urban uses. The major limitations of the soils are depth to bedrock, seasonal wetness, slow permeability, and slope.

8. Cavode-Wharton-Gilpin

Gently sloping to steep, deep and moderately deep, somewhat poorly drained to well drained soils formed in material weathered dominantly from shale

This map unit is throughout all but the northwest part of the county. The unit is on smooth to rolling uplands and in associated drainageways (fig. 6).

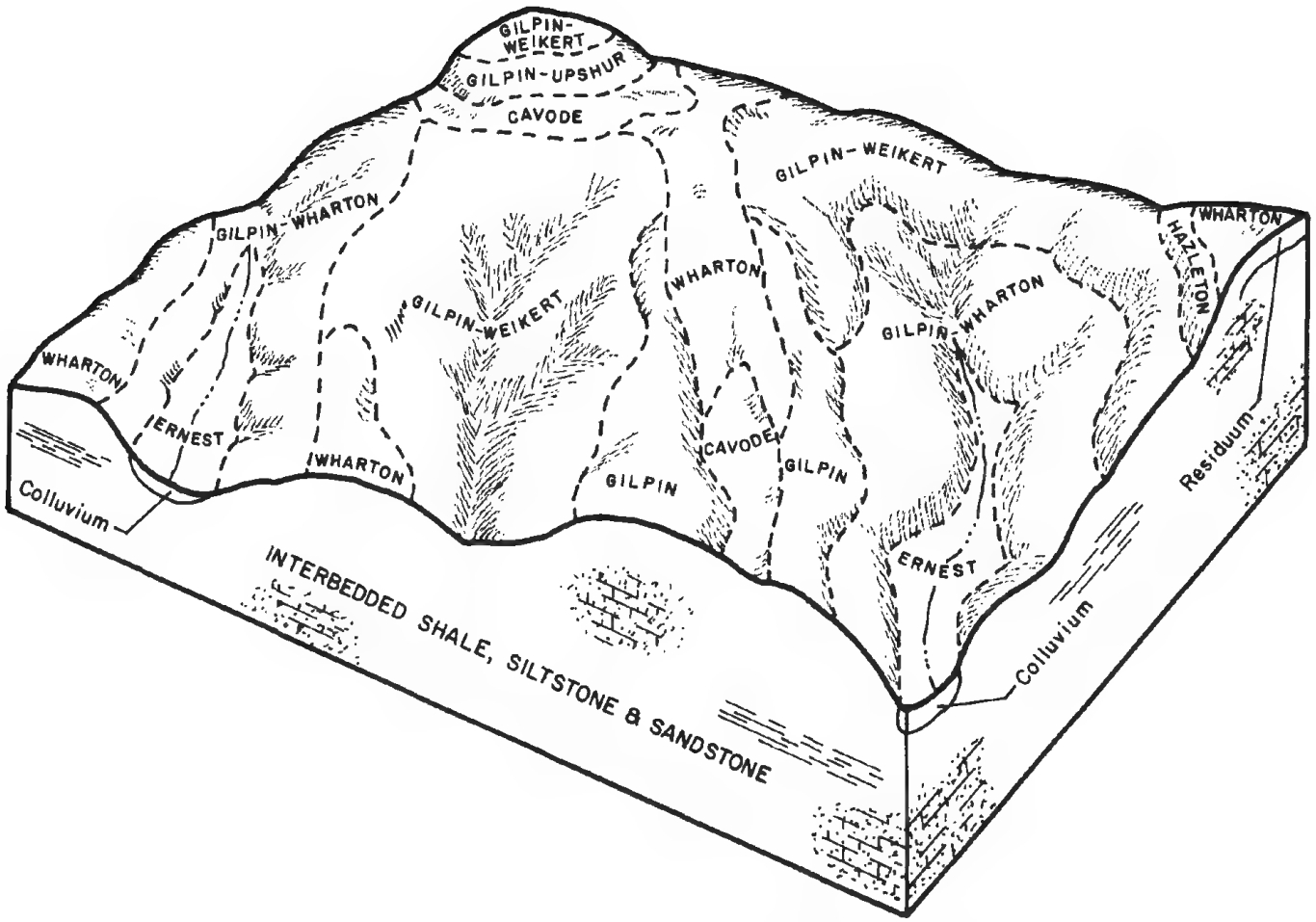

Figure 5.—Typical pattern of soils and underlying material in the Gilpin-Wharton unit.

This unit makes up about 8 percent of the total land area of the county. The unit is about 30 percent Cavode soils, 20 percent Wharton soils, 15 percent Gilpin soils, and 35 percent soils of minor extent.

The Cavode soils are deep and somewhat poorly drained. They have a clayey subsoil and have a seasonal high water table for long periods during wet seasons. They are underlain by shale bedrock at a depth of more than 40 inches. These Cavode soils are dominantly on gently sloping to moderately steep uplands.

The Wharton soils are deep and moderately well drained. They have a seasonal high water table during wet seasons. They are underlain by shale bedrock at a depth of more than 40 inches. These Wharton soils are dominantly on gently sloping to moderately steep uplands.

The Gilpin soils are moderately deep and well drained. They are channery throughout and are underlain by shale and siltstone bedrock at a depth of 20 to 40 inches. These Gilpin soils are dominantly on gently sloping to steep uplands.

Of the minor extent on uplands in this unit are well drained Upshur, Hazleton, and Weikert soils; moderately well drained Tilsit and Cookport soils; and moderately well drained and somewhat poorly drained Vandergrift soils. Moderately well drained Ernest and Buchanan and poorly drained Brinkerton soils are on depressions, foot slopes, and lowlands. Poorly drained Atkins soils are on most flood plains. Udorthents are throughout much of the unit.

Most areas of this unit are used for farmland and woodland. Many areas that were farmed are reverting to brush and woodland. Dairy farming is the major farm

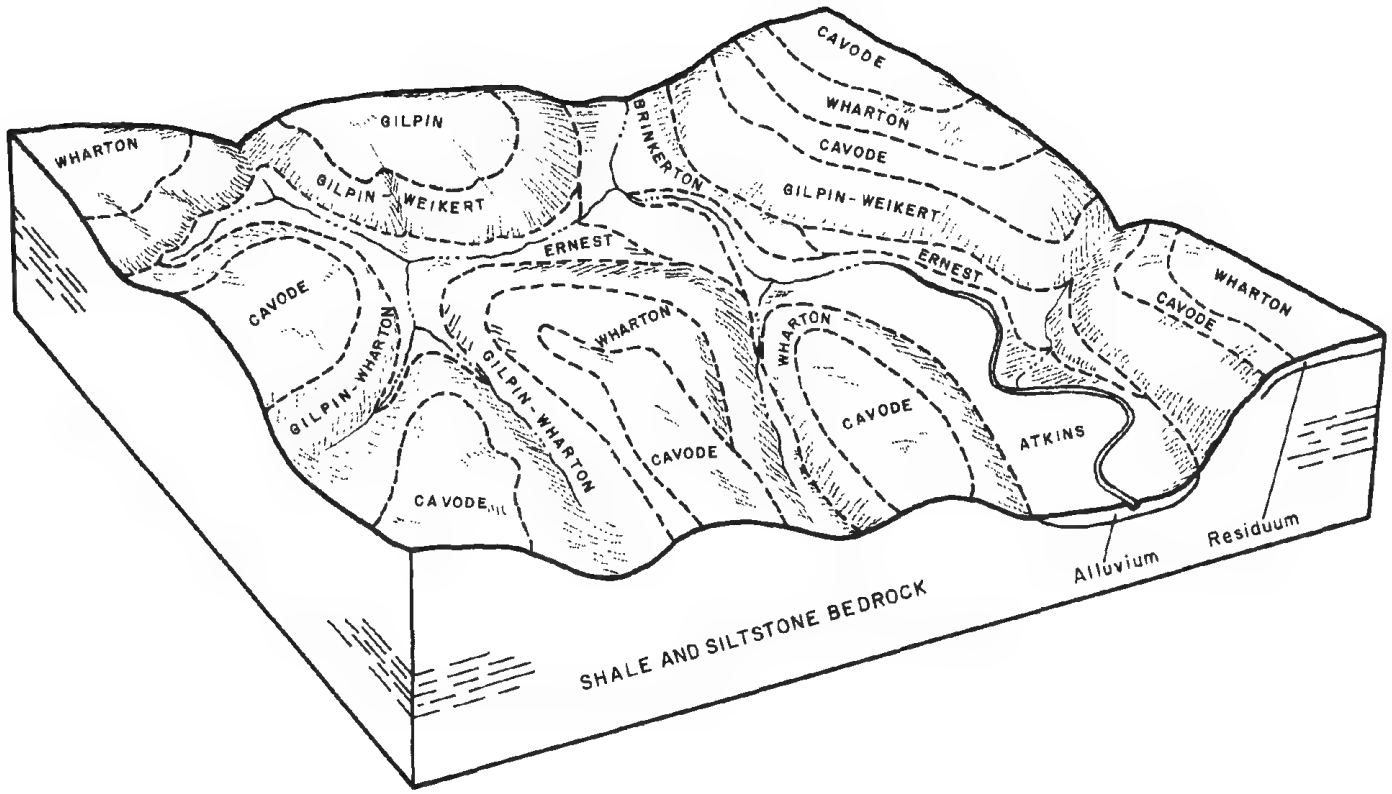

Figure 6.—Typical pattern of the soils and underlying material in the Cavode-Wharton-Gilpin unit.

enterprise. Corn, small grain, and hay and pasture are the major crops. Artificial drainage is usually needed to remove excess water. Suburban development is active along all the major roads. The urban centers are Portersville, Evans City, Callery, Mars, and Cooperstown.

This unit has fair potential for farmland and good potential for woodland and wildlife habitat. It has fair to poor potential for urban uses. The major limitations of the soils are seasonal wetness, unstable soil material, slow permeability, depth to bedrock, and slope.

9. Tilsit-Brinkerton-Gilpin

Nearly level to moderately steep, moderately deep to very deep, well drained to poorly drained soils formed in material weathered dominantly from shale and siltstone

This map unit is throughout the southern half of the county. The largest area is in the vicinity of Saxonburg. The unit is smooth and undulating on uplands, in depressions, and in drainageways (fig. 7).

This unit makes up about 5 percent of the total land area of the county. The unit is about 35 percent Tilsit soils, 20 percent Brinkerton soils, 15 percent Gilpin soils, and 30 percent soils of minor extent.

The Tilsit soils are deep and moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. They are underlain at a depth of more than 40 inches by siltstone bedrock interbedded with shale and sandstone. These Tilsit soils are on nearly level and gently sloping uplands.

The Brinkerton soils are very deep and poorly drained. They have a firm layer, called a fragipan, and have a high water table for much of the year. They are underlain by siltstone and shale bedrock at a depth of more than 60 inches. These Brinkerton soils are dominantly nearly level and gently sloping on lowlands, in depressions, and in minor drainageways.

The Gilpin soils are moderately deep and well drained. They are channery throughout and are underlain by siltstone and shale bedrock at a depth of 20 to 40 inches. These Gilpin soils are dominantly on gently sloping to moderately steep uplands.

Of minor extent on uplands in this unit are well drained Hazleton and Weikert soils, moderately well drained

Wharton and Cookport soils, and somewhat poorly drained Cavode soils. Moderately well drained Ernest and Buchanan soils are in depressions, on benches, and on foot slopes. Poorly drained Atkins soils are on most flood plains.

Most areas of this unit are used for farmland. A few areas of woodland are on lowlands and on slopes near drainageways. Some areas that were farmed are reverting to brush and woodland. Dairying, raising beef, potato farming, and grain farming are the major farm enterprises. Corn, potatoes, small grain, and hay and pasture are the major crops. The urban centers are Saxonburg and Prospect. Suburban development is active along the major roads.

This unit has fair or good potential for farmland and good potential for woodland and wildlife habitat. It has fair to poor potential for urban uses. The major limitations of the soils are seasonal wetness, slow permeability, depth to bedrock, and slope.

10. Udorthents-Wharton-Hazleton

Gently sloping to very steep, very deep and deep, excessively drained to moderately well drained soils formed during strip mining and in material weathered from sandstone, siltstone, and shale

This map unit is throughout the county, but it is mainly in the northern half. Large areas are near Portersville, West Sunbury, Murrinsville, Hooker, and Fairview. The unit is on ridgetops, side slopes, and foot slopes and in drainageways.

This unit makes up about 12 percent of the county. The unit is about 45 percent Udorthents, 10 percent Wharton soils, 10 percent Hazleton soils, and 35 percent soils of minor extent.

The Udorthents are very deep and excessively drained to moderately well drained. They formed by mixing soils with bedrock during strip mining of coal and limestone. Udorthents are very channery throughout. They are on gently sloping to very steep uplands.

The Wharton soils are deep and moderately well drained. They have a seasonal high water table during

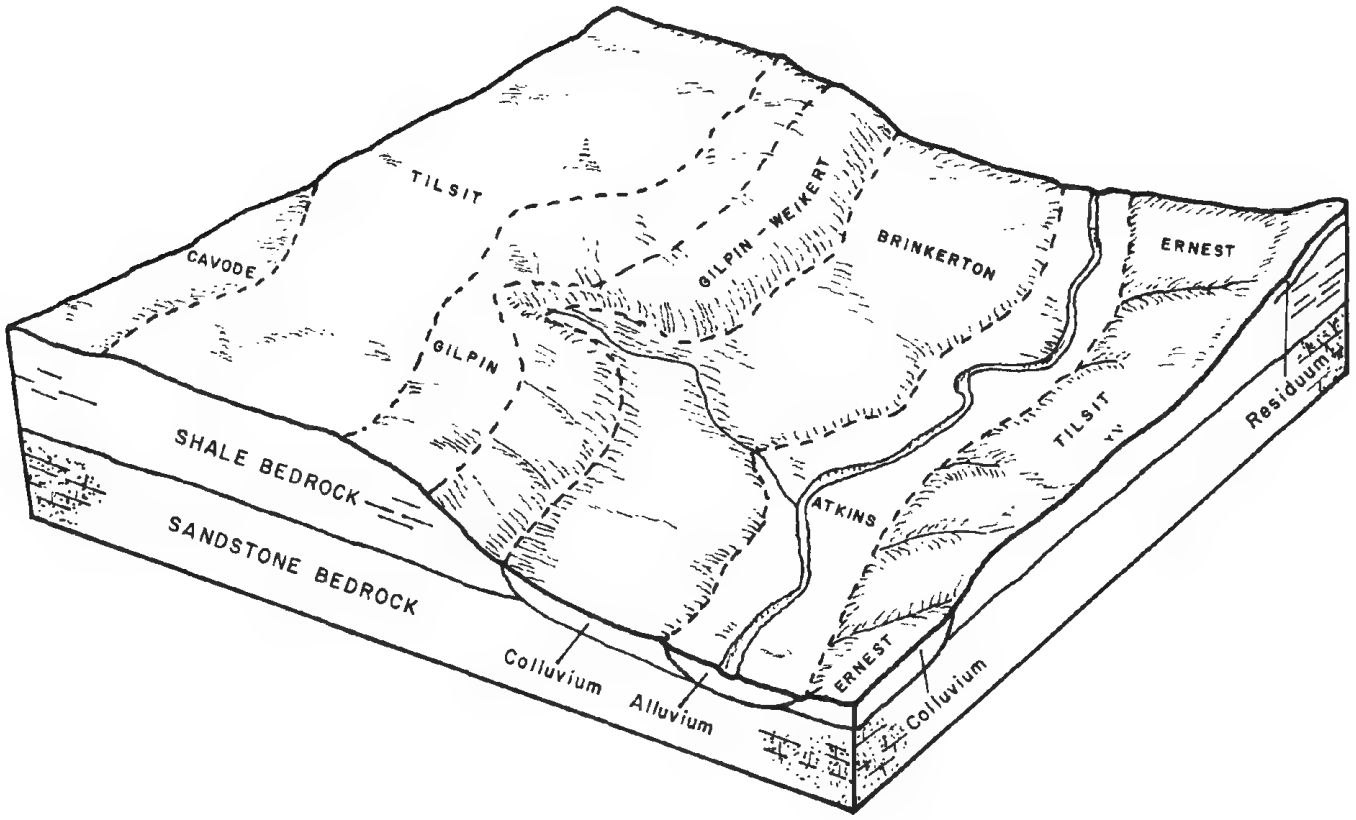

Figure 7.—Typical pattern of soils and underlying material in the Tilsit-Brinkerton-Gilpin unit.

wet seasons. They are underlain by shale and siltstone bedrock at a depth of more than 40 inches. These Wharton soils are dominantly on gently sloping to moderately steep uplands.

The Hazleton soils are deep and well drained. They are channery throughout and are underlain by sandstone bedrock at a depth of more than 40 inches. They are on gently sloping to very steep uplands.

Of minor extent on uplands in this unit are well drained Gilpin and Weikert soils, moderately well drained Cookport soils, and somewhat poorly drained Cavode soils. Moderately well drained Ernest and Buchanan soils

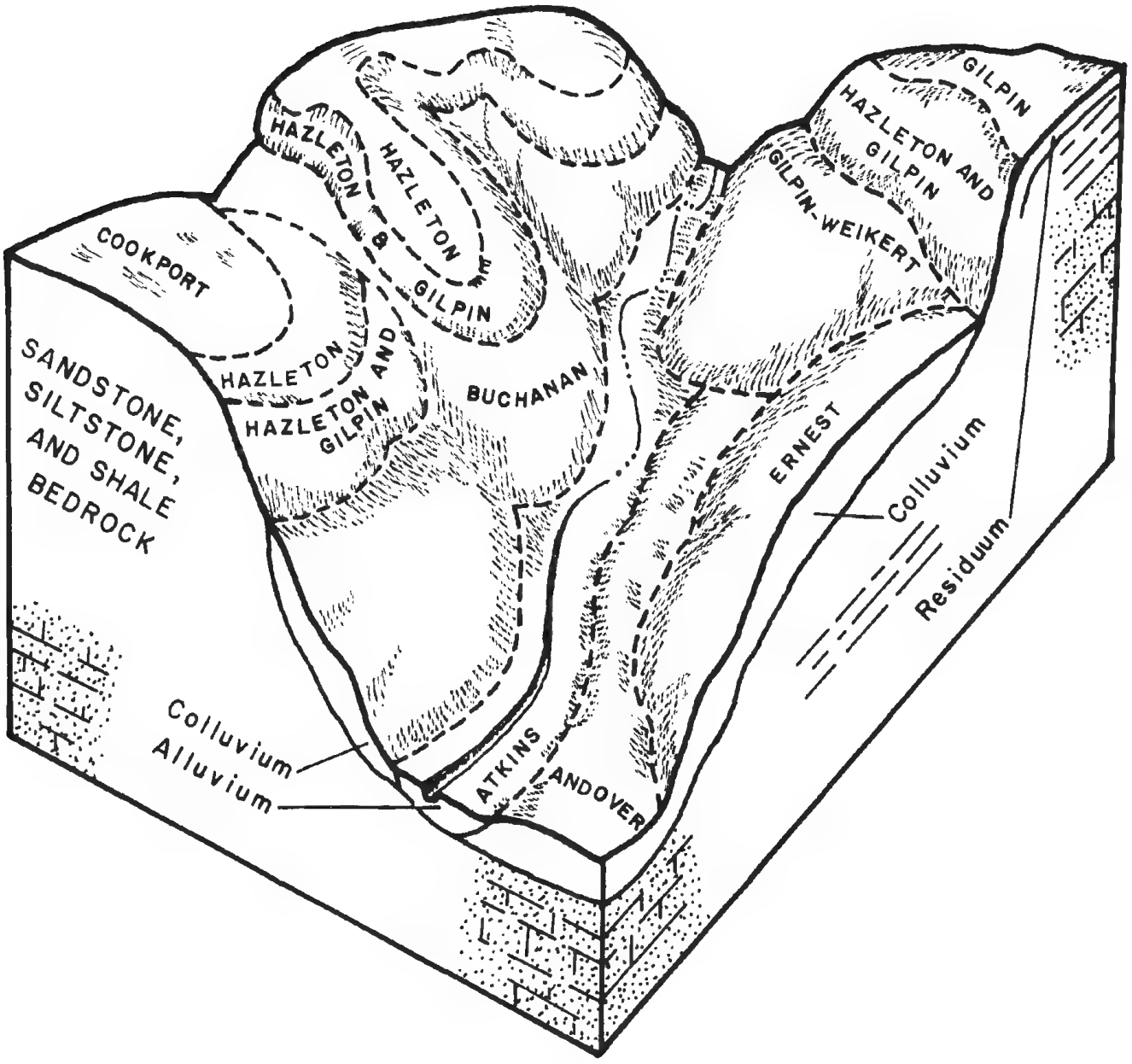

Figure 8.—Typical pattern of soils and underlying material in the Hazleton-Buchanan-Gilpin unit.

and poorly drained Brinkerton and Andover soils are in depressions and on benches, foot slopes, and lowlands. Poorly drained Atkins soils are on most flood plains.

Most areas of this unit are in native vegetation and woodland. A small part is used for farmland. Dairy farming is the major farm enterprise. Corn, small grains, and hay and pasture are the major crops. A large portion of Udorthents is barren or has a sparse plant cover. Trees, primarily conifers, have been planted on some areas. A few areas have been smoothed and are used for farmland.

This unit has poor potential for farmland and fair to poor potential for woodland and wildlife habitat. It has poor potential for urban uses. The major limitations of the soils are low available water capacity, slope, many small stones on the surface, and seasonal wetness.

11. Hazleton-Buchanan-Gilpin

Gently sloping to very steep, moderately deep to very deep, well drained and moderately well drained, dominantly very stony soils formed in material weathered from sandstone, siltstone, and shale

This map unit is near the major streams and their tributaries in all but the northwest corner of the county. The largest areas are in the northeast and north-central parts. This unit is on ridges, hills, benches, foot slopes, and associated flood plains (fig. 8).

This unit makes up about 17 percent of the county. The unit is about 25 percent Hazleton soils, 20 percent Buchanan soils, 15 percent Gilpin soils, and 40 percent soils of minor extent.

The Hazleton soils are deep and well drained. They are dominantly very stony and are underlain by sandstone bedrock at a depth of more than 40 inches. These Hazleton soils are on gently sloping to very steep ridges and hills.

The Buchanan soils are very deep and moderately well drained. They have a firm layer, called a fragipan, and have a seasonal high water table during wet seasons. They are mainly very stony and are underlain by sandstone bedrock at a depth of more than 60 inches. These Buchanan soils are dominantly gently sloping to moderately steep on benches, on foot slopes, and in drainageways.

The Gilpin soils are moderately deep and well drained. They are dominantly very stony and are underlain by shale and siltstone bedrock at a depth of 20 to 40 inches. These soils are mainly on strongly sloping to very steep ridges and hillsides.

Of minor extent on uplands in this unit are Udorthents, well drained Weikert soils, and moderately well drained Wharton and Cookport soils. Moderately well drained Ernest soils and poorly drained Andover and Brinkerton soils are on benches, on foot slopes, in drainageways, and on lowlands. Poorly drained Atkins soils are on most flood plains.

Most areas of this unit are in woodland and brushland. A few small areas on ridgetops are used for farmland. Some areas that were farmed are reverting to brush and woodland.

This unit generally is too steep or too stony for farmland. It has good potential for woodland and wildlife habitat. It has poor potential for urban uses. The major limitations of the soils are slope, many large stones on the surface, seasonal wetness, and depth to bedrock.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the county. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hazleton channery loam, 3 to 8 percent slopes, is one of several phases in the Hazleton series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gilpin-Wharton complex, 15 to 25 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Titusville and Riverhead soils, 15 to 30 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AnA—Andover loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and poorly drained. It is on lowlands and in depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is 32 inches thick. The upper 11 inches of the subsoil is grayish brown, mottled, friable to firm loam. The lower 21 inches is grayish brown and yellowish brown, mottled, very firm and brittle sandy clay loam. The substratum is brown and dark grayish brown, mottled, firm to very firm channery sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of gently sloping Andover soils and many areas of soils similar to this Andover soil but that are brown and mottled with gray in the upper part of the subsoil or that are more sandy throughout. Also included are small areas of Atkins, Buchanan, Ernest, and Brinkerton soils.

The permeability of this Andover soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The high water table is between the surface and depth of 6 inches for a major part of the year. Runoff is slow, and ponding is common during wet seasons. The available water capacity is low to moderate. In unlimed areas, this soil is strongly acid or very strongly acid throughout. Rooting is restricted by the high water table and the firm part of the subsoil.

If drained, this soil is fairly well suited to corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa, and the high water table and the ponding after heavy rains damage some crops. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IVw; woodland ordination: 4W.

AnB—Andover loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and poorly drained. It is on benches, on foot slopes, and in depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is 32 inches thick. The upper 11 inches of the subsoil is grayish brown, mottled, friable to firm loam. The lower 21 inches is grayish brown and yellowish brown, mottled, very firm and brittle sandy clay loam. The substratum is brown and dark grayish brown, mottled, firm to very firm channery sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of nearly level to strongly sloping Andover soils and many areas of soils similar to this Andover soil but that are brown and mottled with gray in the upper part of the subsoil, or are more sandy throughout. In a few areas bedrock is at a depth of less than 60 inches or the soils are stony. Also included are small areas of Atkins, Buchanan, Cookport, Ernest, and Brinkerton soils throughout the unit. Ponding is common in depressions during wet seasons.

The permeability of this Andover soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The high water table is between the surface and depth of 6 inches for a major part of the year. Runoff is slow to medium. The available water capacity is low to moderate. In unlimed areas, this soil is strongly acid or very strongly acid throughout. Rooting is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for pasture or woodland.

If drained, this soil is fairly well suited to corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring. The water table and the ponding in depressions after heavy rainfall damage some crops. Keeping natural drainageways open, using surface drains, and using subsurface drains will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass IVw; woodland ordination 4W.

AnC—Andover loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and poorly drained. It is on foot slopes and benches throughout all but the extreme northwest part of the county. Slopes are smooth

or concave. The areas are long and narrow and range from 1 acre to 25 acres.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is 32 inches thick. The upper 11 inches of the subsoil is grayish brown, mottled, friable to firm loam. The lower 21 inches is grayish brown and yellowish brown, mottled, very firm and brittle sandy clay loam. The substratum is brown and dark grayish brown, mottled, firm to very firm channery sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping to moderately steep Andover soils and many areas of soils similar to this Andover soil but that are brown and mottled with gray in the upper part of the subsoil, are more sandy throughout, or have bedrock at a depth of less than 60 inches. A few areas are stony. Also included are small areas of Atkins, Buchanan, Cookport, Ernest, and Brinkerton soils throughout the unit.

The permeability of this Andover soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The high water table is between the surface and depth of 6 inches for a major part of the year. Runoff is medium. The available water capacity is low to moderate. In unlimed areas, this soil is strongly acid or very strongly acid throughout. Rooting is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for pasture or woodland.

If drained, this soil is fairly well suited to corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drainage, and using subsurface drainage will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

Slope, the permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IVw; woodland ordination: 4W.

AoB—Andover loam, 0 to 8 percent slopes, very stony. This soil is nearly level and gently sloping, very deep, and poorly drained. It is on foot slopes, on benches, and in depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 100 acres. About 3 to 15 percent of the surface is covered with stones that range from about 1 foot to 4 feet in diameter.

Typically, the surface layer is black loam about 3 inches thick. The subsurface layer is grayish brown loam about 7 inches thick. The subsoil is 32 inches thick. The upper 11 inches of the subsoil is grayish brown, mottled, friable to firm loam. The lower 21 inches is grayish brown and yellowish brown, mottled, very firm and brittle sandy clay loam. The substratum is brown and dark grayish brown, mottled, firm to very firm channery sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of sloping Andover soils and soils similar to this Andover soil but that are brown and mottled with gray in the upper part of the subsoil, are more sandy throughout, or have bedrock at a depth of less than 60 inches. Some areas in this unit do not have stones on the surface. Also included are small areas of Wharton, Cavode, Cookport, Buchanan, Ernest, Brinkerton, and Atkins soils.

The permeability of this Andover soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The high water table is between the surface and depth of 6 inches for a major part of the year. Runoff is slow, and ponding is common during wet seasons. The available water capacity is low to moderate. In unlimed areas, this soil is strongly acid or very strongly acid throughout. Rooting is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for woodland, but a few areas are in pasture.

Because of the stones on the surface, this soil is unsuited to cropland and poorly suited to pasture.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Use of equipment for planting, maintaining, and harvesting trees is restricted by the high water table.

The stones on the surface, the high water table, and the slow permeability limit this soil as a site for waste disposal, buildings, and local roads and streets.

Capability subclass: VIIs; woodland ordination: 4W.

AoC—Andover loam, 8 to 15 percent slopes, very stony. This soil is strongly sloping, very deep and poorly

drained. It is on foot slopes and benches throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are long and narrow and range from 2 to 100 acres. About 3 to 15 percent of the surface is covered with stones that range from about 1 foot to 4 feet in diameter.

Typically, the surface layer is black loam about 3 inches thick. The subsurface layer is grayish brown loam about 7 inches thick. The subsoil is 32 inches thick. The upper 11 inches of the subsoil is grayish brown, mottled, friable to firm loam. The lower 21 inches is grayish brown and yellowish brown, mottled, very firm and brittle sandy clay loam. The substratum is brown and dark grayish brown, mottled, firm to very firm channery sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping Andover soils and soils similar to this Andover soil but that are brown and mottled with gray in the upper part of the subsoil, are more sandy throughout, or have bedrock at a depth of less than 60 inches. Some areas in this unit do not have stones on the surface.

The permeability of this Andover soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow and slow in the substratum. The high water table is between the surface and a depth of 6 inches for a major part of the year. Runoff is medium. The available water capacity is low to moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for woodland, but a few areas are used for pasture.

Because of the stones on the surface, this soil is unsuited to cropland and poorly suited to pasture.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Use of equipment for planting, maintaining, and harvesting trees is restricted by the high water table.

Slope, the stones on the surface, the high water table, and the slow permeability limit this soil as a site for waste disposal, buildings, and local roads and streets.

Capability subclass: VIIs; woodland ordination: 4W.

Ar—Arents-Urban land complex. This unit is nearly level to very steep. It consists of shallow to very deep, moderately well drained to somewhat excessively drained soils and Urban land. It is on ridgetops, side slopes, benches, lowlands, and flood plains throughout the county. Slopes are smooth, convex, or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 200 acres. The Arents and Urban land are in such an intricate pattern that it was impractical to map them separately. Slope ranges from 0 to 100 percent.

About 60 percent of this unit is nearly level to very steep Arents in areas that have been excavated or filled. They consist of different kinds of earthy material, rock fragments, and parts of the original soils.

About 30 percent of this unit is nearly level to sloping Urban land. This part of the unit is covered by highways, railroads, parking lots, factories, shopping centers, and other structures.

Included with this unit in mapping are escarpments and small areas of Gilpin, Weikert, Hazleton, Wharton, Cavode, Brinkerton, and Atkins soils. They make up about 10 percent of the unit.

Permeability, available water capacity, and runoff are variable in this unit. Arents dominantly are slightly acid to extremely acid. The depth to bedrock is 12 inches or more. Many areas are surface drained through sewer systems and open drains. After heavy rainfall, water ponds on the surface of some depressions and compacted areas.

Most areas of this unit are used for highways, railroads, industries, and urban developments. The Arents are mostly in grass, trees, or sparse vegetation, or they are barren.

The excavated areas that are steep, shallow, or contain many rock fragments are droughty and poorly suited to most plants. Seeding these areas with shallow-rooting, drought-resistant grasses and legumes will reduce runoff and control erosion. Most filled areas and the excavated areas that are not too steep or shallow to bedrock are fairly well suited to grass, trees and shrubs, landscaping, or recreation areas.

Many areas are too steep for urban uses. The nearly level to gently sloping excavated areas are generally suitable as sites for buildings. Wetness and the depth to bedrock are limitations in some areas. Areas of fill vary in their suitability for urban uses. They are frequently unstable and subject to settling, depending on the type of material and the degree of compaction. The properties of this unit are so variable that an onsite investigation is needed to determine the potential and limitations for any use.

Capability subclass and woodland ordination: not assigned.

At—Atkins silt loam. This soil is nearly level, very deep, and poorly drained. It is on flood plains throughout the county. The areas are long and narrow and mainly range from 2 to 30 acres. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer and subsoil have a combined thickness of 39 inches. They are olive gray, mottled, friable to firm silt loam. The substratum is dark yellowish brown, mottled, firm loam to a depth of 60 inches or more.

Included with this soil in mapping are areas of soils similar to this Atkins soil but that have a thick, black surface layer, are not as gray in the upper 20 inches, or are more sandy throughout. Also included are small

areas of Canadice, Brinkerton, Andover, Philo, Pope, Ernest, and Buchanan soils.

The permeability of this Atkins soil is moderate to slow in the subsoil and moderately rapid to moderately slow in the substratum. The available water capacity is high. Runoff is slow, ponding is common, and flooding is frequent. The high water table is between the surface and a depth of 12 inches for a major part of the year. In unlimed areas this soil is strongly acid or very strongly acid throughout. The rooting depth is restricted by the high water table.

Most areas of this soil are used for pasture and woodland or are in native vegetation.

If drained, this soil is suitable for corn, other cultivated crops, and grasses and legumes. Many areas are small and inaccessible and are divided by streams, and many depressions cannot be drained. Wetness and frost heaving damage winter grains and alfalfa, and the high water table and the ponding after heavy rains damage some crops. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderate. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The flooding and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 3W.

BeA—Braceville loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and moderately well drained. It is on outwash plains and terraces dominantly in the northwest part of the county. Slopes are smooth. The areas are irregular in shape and range from 2 to 25 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is 25 inches thick. The upper 9 inches of the subsoil is dark yellowish brown, mottled fine sandy loam. The lower 16 inches is dark brown, mottled, firm and brittle gravelly and very gravelly sandy loam. The substratum extends to a depth of 60 inches or more. It is yellowish brown and brown, very friable and loose, stratified extremely gravelly loamy sand, gravelly sandy loam, and sand.

Included with this soil in mapping are a few areas of gently sloping Braceville soils and soils similar to this Braceville soil but that contain more clay in the surface layer and subsoil, are friable throughout the subsoil, or are mottled only at a depth of more than 30 inches. Also included are small areas of Wheeling, Riverhead, Fredon, and Titusville soils.

The permeability of this Braceville soil is moderate and moderately slow above the firm part of the subsoil, moderately slow and slow in the firm part of the subsoil, and rapid and moderately rapid in the substratum. The seasonal high water table is at a depth of 18 to 36 inches during wet seasons. Runoff is slow. The available water capacity is moderate. In unlimed areas, the soil is very strongly acid to moderately acid above the firm part of the subsoil and strongly acid to slightly acid in the firm part and in the substratum. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture. A few areas are in woodland or native vegetation.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Wetness delays plowing in the spring. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, and mixing crop residue into the surface layer will improve tilth and reduce runoff and erosion. Subsurface drains improve drainage and allow timely tillage.

This soil is well suited to pasture. Overgrazing and grazing when the soil is wet are the major concerns of pasture management. Proper stocking rates, rotation grazing, and restricting grazing during wet periods will help to keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. In some areas the seasonal high water table and the firm part of the subsoil restrict root development. Removing undesirable species will help increase production and conserve moisture. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIw; woodland ordination: 4A.

BeB—Braceville loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and moderately well drained. It is on outwash plains, kames, and terraces dominantly in the northwest part of the county. Slopes

are smooth, convex, or concave. The areas are irregular in shape and range from 2 to 25 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is 25 inches thick. The upper 9 inches of the subsoil is dark yellowish brown, mottled fine sandy loam. The lower 16 inches is dark brown, mottled, firm and brittle gravelly and very gravelly sandy loam. The substratum extends to a depth of 60 inches or more. It is yellowish brown and brown, very friable and loose, stratified extremely gravelly loamy sand, gravelly sandy loam, and sand.

Included with this soil in mapping are a few areas of nearly level and sloping Braceville soils and soils similar to this Braceville soil but that contain more clay in the surface layer and subsoil, are friable throughout the subsoil, or are mottled only at a depth of more than 30 inches. Also included are small areas of Wheeling, Riverhead, Fredon, and Titusville soils.

The permeability of this Braceville soil is moderate and moderately slow above the firm part of the subsoil, moderately slow and slow in the firm part of the subsoil, and rapid and moderately rapid in the substratum. The seasonal high water table is at a depth of 18 to 36 inches during wet seasons. Runoff is medium. The available water capacity is moderate. In unlimed areas the soil is very strongly acid to moderately acid above the firm part of the subsoil and strongly acid to slightly acid in the firm part and in the substratum. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture. A few areas are in woodland or native vegetation.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Erosion is a moderate hazard, and wetness delays plowing. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Subsurface drainage improves drainage and allows timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Overgrazing and grazing when the soil is wet are the major concerns of pasture management. Proper stocking rates, rotation grazing, and restricting grazing during wet periods will help to keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. In some areas the seasonal high water table and the firm part of the subsoil restrict root development. Removing undesirable species will help increase production and conserve moisture. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIw; woodland ordination: 4A.

BeC—Braceville loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and moderately well drained. It is on outwash plains, kames, and terraces dominantly in the northwest part of the county. Slopes are convex or concave. The areas are long and narrow and range from 2 to 30 acres.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is 25 inches thick. The upper 9 inches of the subsoil is dark yellowish brown, mottled fine sandy loam. The lower 16 inches is dark brown, mottled, firm and brittle gravelly and very gravelly sandy loam. The substratum extends to a depth of 60 inches or more. It is yellowish brown and brown, very friable and loose, stratified extremely gravelly loamy sand, gravelly sandy loam, and sand.

Included with this soil in mapping are a few small areas of gently sloping and moderately steep Braceville soils and soils similar to this Braceville soil but that are friable throughout the subsoil or are mottled only at a depth of more than 30 inches. Also included are small areas of Wheeling, Riverhead, and Titusville soils.

The permeability of this Braceville soil is moderate and moderately slow above the firm part of the subsoil, moderately slow and slow in the firm part of the subsoil, and rapid and moderately rapid in the substratum. The seasonal high water table is at a depth of 18 to 36 inches during wet seasons. Runoff is medium to rapid. The available water capacity is moderate. In unlimed areas the soil is very strongly acid to moderately acid above the firm part of the subsoil and strongly acid to slightly acid in the firm part and in the substratum. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are in woodland or native vegetation. Some areas are used for cropland or pasture.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Erosion is a moderate to severe hazard, and wetness delays plowing. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Subsurface drainage improves drainage and allows timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Overgrazing and grazing when the soil is wet are the major concerns of pasture management. Proper stocking rates, rotation

grazing, and restricting grazing during wet periods will help to keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. In some areas the seasonal high water table and the firm part of the subsoil restrict root development. Removing undesirable species will help increase production and conserve moisture. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

Slope, the permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4A.

BrA—Brinkerton silt loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and poorly drained. It is on lowlands and in depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 1 to 200 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 39 inches thick. The upper 11 inches of the subsoil is light brownish gray, mottled silt loam. The lower 28 inches is gray, mottled, firm and brittle silt loam and channery silt loam. The substratum is brown, mottled, firm channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping Brinkerton soils and soils similar to this Brinkerton soil but that have a thick, black surface layer, contain more rock fragments throughout, or have a subsoil that is friable throughout. Also included are areas of Ernest, Andover, Atkins, Cavode, Wharton, Tilsit, and Cookport soils.

The permeability of this Brinkerton soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow and slow in the substratum. Runoff is slow, and ponding is common during wet seasons. This soil has a high water table between the surface and a depth of 6 inches for a major part of the year. The available water capacity is moderate. In unlimed areas this soil is very strongly acid to moderately acid in the surface layer and subsoil and strongly acid to slightly acid in the substratum. The rooting depth is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for pasture and woodland or are in native vegetation.

If drained, this soil has fair to poor suitability for corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa, and the high water table and the ponding after heavy rains damage some crops. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IVw; woodland ordination: 4W.

BrB—Brinkerton silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and poorly drained. It is on benches, foot slopes, and lowlands throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 200 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 39 inches thick. The upper 11 inches of the subsoil is light brownish gray, mottled silt loam. The lower 28 inches is gray, mottled, firm and brittle silt loam and channery silt loam. The substratum is brown, mottled, firm channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of nearly level and strongly sloping Brinkerton soils and soils similar to this Brinkerton soil but that contain more rock fragments throughout, are less than 60 inches deep to bedrock, are not as gray in the upper 15 inches, or have a subsoil that is friable throughout. Also included are small areas of Ernest, Andover, Atkins, Buchanan, Wharton, Cavode, Tilsit, and Cookport soils.

The permeability of this Brinkerton soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow and slow in the substratum. Runoff is slow to medium, and ponding is common during wet seasons. This soil has a high water table between the surface and a depth of 6 inches for a major part of the year. The available water capacity is moderate. In unlimed areas this soil is very strongly acid to moderately acid in the surface layer and subsoil and strongly acid to slightly acid in the substratum. The rooting depth is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture. Some areas are in woodland or native vegetation.

If drained, this soil has fair to poor suitability for corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IVw; woodland ordination: 4W.

BrC—Brinkerton silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and poorly drained. It is on foot slopes and benches throughout all but the extreme northwest part of the county. Slopes generally are smooth or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 39 inches thick. The upper 11 inches of the subsoil is light brownish gray, mottled silt loam. The lower 28 inches is gray, mottled, firm and brittle silt loam and channery silt loam. The substratum is brown, mottled, firm channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping and moderately steep Brinkerton soils and soils similar to this Brinkerton soil but that are less than 60 inches deep to bedrock, contain more rock fragments throughout, are not as gray in the upper 18 inches, or have a subsoil that is friable throughout. Also included are small areas of Ernest, Andover, Buchanan, Wharton, Cavode, Gilpin, and Cookport soils.

The permeability of this Brinkerton soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow and slow in the substratum. Runoff is medium to rapid. This soil has a high water table between the surface and a depth of 6 inches for a major part of the year. The available water capacity is moderate. In unlimed areas this soil is very strongly acid to moderately acid in the surface layer and subsoil and strongly acid to slightly acid in the substratum. The rooting depth is restricted by the high water table and the firm part of the subsoil.

Most areas of this soil are used for pasture, woodland, or native vegetation. A few areas are in cropland.

This soil has fair to poor suitability for corn and oats. The soil is well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring. Erosion is a moderate to severe hazard. Using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

Slope, the permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IVw; woodland ordination: 4W.

BuB—Buchanan loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and moderately well drained. It is on foot slopes, on benches, on lowlands, and in depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is 52 inches thick. The upper 21 inches of the subsoil is yellowish brown and brown loam and clay loam that is mottled in the lower part. The lower 31 inches is brown and dark yellowish brown, mottled, very firm and brittle channery clay loam and very channery loam. The substratum, at a depth of

more than 60 inches, is grayish brown and yellowish brown, firm very channery sandy loam.

Included with this soil in mapping are small areas of nearly level and sloping Buchanan soils and soils similar to this Buchanan soil but that are more sandy throughout. Also included are small areas of Cookport, Ernest, Andover, Atkins, Hazleton, and Clymer soils.

The permeability of this Buchanan soil is moderate above the firm part of the subsoil and slow in the firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is slow to medium. In unlimed areas this soil is strongly acid to extremely acid throughout. The available water capacity is moderate. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture.

This soil is well suited to corn, vegetables, oats, and grasses and legumes. Frost heaving and wetness damage some grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Diversions and subsurface drainage improve drainage and allow timely tillage.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. In some areas the seasonal high water table and the firm part of the subsoil restrict root development. Removing undesirable species will help increase production and conserve moisture. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIe; woodland ordination: 4A.

BuC—Buchanan loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and moderately well drained. It is on foot slopes and benches throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is 52 inches thick. The upper 21 inches of the subsoil is yellowish brown and brown loam and clay loam that is mottled in the lower part. The lower 31 inches is brown and dark yellowish brown, mottled, very firm and brittle channery clay loam and very channery loam. The substratum, at a depth of more than 60 inches, is grayish brown and yellowish brown, firm very channery sandy loam.

Included with this soil in mapping are small areas of gently sloping and moderately steep Buchanan soils and soils similar to this Buchanan soil but that are more sandy throughout. Also included are small areas of Gilpin, Hazleton, Clymer, Ernest, Cookport, and Andover soils.

The permeability of this Buchanan soil is moderate above the firm part of the subsoil and slow in the firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is medium to rapid. In unlimed areas this soil is strongly acid to extremely acid throughout. The available water capacity is moderate. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for pasture or woodland. Many areas that were farmed are reverting to brush and woodland.

This soil is fairly well suited to corn and oats and well suited to grasses and legumes. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Subsurface drainage improves drainage and allows timely tillage.

This soil is well suited to permanent pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. In some areas the seasonal high water table and the firm part of the subsoil restrict root development. Removing undesirable species will help increase production and conserve moisture. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

Slope, the permeability, and the seasonal high water table limit this soil for urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4A.

BxB—Buchanan loam, 0 to 8 percent slopes, very stony. This soil is nearly level and gently sloping, very deep, and moderately well drained. It is on foot slopes, benches, and lowlands throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 100 acres. About 3 to 15

percent of the surface is covered with stones that range from about 1 foot to 4 feet in diameter.

Typically, the surface layer is very dark gray loam about 2 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is 54 inches thick. The upper 23 inches of the subsoil is yellowish brown and brown loam and clay loam that is mottled in the lower part. The lower 31 inches is brown and dark yellowish brown, mottled, very firm and brittle channery clay loam and very channery loam. The substratum, at a depth of more than 60 inches, is grayish brown and yellowish brown, firm very channery sandy loam.

Included with this soil in mapping are small areas of sloping and moderately steep Buchanan soils and soils similar to this Buchanan soil but that are more sandy throughout or are underlain by bedrock at a depth of less than 5 feet. In a few areas of this unit, stones cover less than 3 percent of the surface or 15 to 50 percent of the surface. Also included are small areas of Cookport, Wharton, Cavode, Ernest, Andover, Brinkerton, and Atkins soils.

The permeability of this Buchanan soil is moderate above the firm part of the subsoil and slow in the firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is slow to medium. In unlimed areas this soil is strongly acid to extremely acid throughout. The available water capacity is moderate. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for woodland, but a few areas are in pasture.

Because of the stones on the surface, this soil is unsuited to cropland and poorly suited to pasture.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Use of equipment for planting, maintaining, and harvesting trees is restricted by the seasonal high water table for brief periods during wet seasons.

The stones on the surface, the seasonal high water table, and the slow permeability limit this soil as a site for waste disposal, buildings, and local roads and streets.

Capability subclass: VIs; woodland ordination: 4A.

BxD—Buchanan loam, 8 to 25 percent slopes, very stony. This soil is strongly sloping and moderately steep, very deep, and moderately well drained. It is on foot slopes and benches throughout all the extreme northwest part of the county. Slopes are smooth, concave, or convex. The areas are irregular in shape or long and narrow and range from 2 to 200 acres. About 3 to 15 percent of the surface is covered with stones that range from about 1 foot to 4 feet in diameter.

Typically, the surface layer is very dark gray loam about 2 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is 54 inches thick. The upper 23 inches of the subsoil is yellowish brown and brown loam and clay loam that is mottled in the lower part. The lower 31 inches is brown and dark yellowish brown, mottled, very firm and brittle channery clay loam and very channery loam. The substratum, at a depth of more than 60 inches, is grayish brown and yellowish brown, firm very channery sandy loam.

Included with this soil in mapping are small areas of gently sloping and steep Buchanan soils and soils similar to this Buchanan soil but that are more sandy throughout or are underlain by bedrock at a depth of less than 5 feet. In some small areas in this unit, stones cover less than 3 percent of the surface or 15 to 50 percent of the surface. Also included are small areas of Gilpin, Hazleton, Cookport, Cavode, Wharton, Ernest, and Andover soils.

The permeability of this Buchanan soil is moderate above the firm part of the subsoil and slow in the firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is slow to medium. In unlimed areas this soil is strongly acid to extremely acid throughout. The available water capacity is moderate. Rooting depth is restricted by the seasonal high water table and the firm part of the subsoil.

Most areas of this soil are used for woodland, but a few areas are in pasture.

Because of the stones on the surface, this soil is unsuited to cropland and poorly suited to pasture.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species will help increase production. Use of equipment for planting, maintaining, and harvesting trees is restricted by slope and by the seasonal high water table for brief periods during wet seasons.

Slope, the stones on the surface, the seasonal high water table, and the slow permeability limit this soil as a site for waste disposal, buildings, and local roads and streets.

Capability subclass: VIs; woodland ordination: 4A.

Cd—Canadice silty clay loam. This soil is nearly level, very deep, and poorly drained. It is on lowlands and in depressions in broad valleys along Muddy and Slippery Rock Creeks and their tributaries and in a few small areas along Connoquenessing and Brush Creeks. Slopes are smooth. The areas are irregular in shape or long and narrow and range from 5 to 150 acres. Slope ranges from 0 to 5 percent but is dominantly 0 to 3 percent.

Typically, the surface layer is very dark grayish brown silty clay loam about 11 inches thick. The subsoil is firm and mottled and is 49 inches thick. The upper 16 inches of the subsoil is gray and grayish brown silty clay loam. The lower 33 inches is gray silty clay. The substratum, at

a depth of more than 60 inches, is gray, mottled, firm silty clay.

Included with this soil in mapping are small areas of gently sloping Canadice soils and soils similar to this Canadice soil but that have a black or very dark gray surface layer up to 24 inches thick and, in a few areas near Connoquenessing and Brush Creeks, are moderately acid to very strongly acid throughout. Also included are small areas of Brinkerton, Frenchtown, Caneadea, Gresham, Cavode, Fredon, Atkins, Riverhead, and Braceville soils.

The permeability of this Canadice soil is very slow, and the available water capacity is high. The high water table is between the surface and a depth of 12 inches for a major part of the year. Runoff is slow, and ponding is common in low areas and depressions. In unlimed areas this soil is slightly acid to very strongly acid in the surface layer, strongly acid to neutral in the upper part of the subsoil, and neutral to moderately alkaline in the lower part of the subsoil and in the substratum. The rooting depth is restricted by the high water table and by the subsoil.

Most areas of this soil have a cover of grasses, sedges, cattails, and alders. Some areas are used for pasture or woodland, and a few small areas are in cropland.

Some areas of this soil can be used for cropland if they are drained. The soil is fairly well suited to shallow-rooted grasses and legumes. Excess water delays plowing, and crops are frequently damaged by the high water table and ponding following intensive rainfalls. The high water table, ponding, and frost heaving damage fall-sown grains and alfalfa. Excess water can sometimes be removed by keeping natural drainageways open and by constructing surface drains where outlets are available.

This soil has fair to poor suitability for pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open and using surface drains where outlets are available will improve surface drainage.

This soil is poorly suited to trees. Potential productivity is moderate. Rooting depth is restricted by the high water table and by the subsoil and substratum. The high water table limits the use of equipment for much of the year. Machine planting on large areas that are drained is sometimes practical.

This soil is limited for urban use because of the permeability, the high water table, the ponding, stream overflow, and the clayey texture. The soil is suitable for wildlife habitat.

Capability subclass: IVw; woodland ordination: 2W.

CeA—Caneadea silt loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and somewhat poorly drained. It is on benches and lowlands near Slippery Rock Creek, Muddy Creek, and their tributaries. A few areas are along Connoquenessing and Brush Creeks. Slopes are smooth. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence from the top, it is 5 inches of light olive brown, mottled silty clay loam; 11 inches of yellowish brown and grayish brown, mottled, firm silty clay and silty clay loam; and 36 inches of gray, mottled, firm silty clay and silty clay loam.

Included with this soil in mapping are small areas of gently sloping Caneadea soils and soils similar to this Caneadea soil but that contain less clay in the subsoil and substratum, have a fragipan, or are moderately acid to very strongly acid throughout. Also included are small areas of Canadice, Brinkerton, Fredon, Frenchtown, Gresham, Cavode, Wharton, Ernest, and Monongahela soils.

The permeability of this Caneadea soil is slow. Runoff is slow, and ponding is common during wet seasons. In unlimed areas this soil is very strongly acid to moderately acid in the upper part and slightly acid to neutral in the lower part. The available water capacity is high, and the seasonal high water table is at a depth of 6 to 18 inches for long periods. Rooting depth is restricted by the seasonal high water table and by the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture or are in native vegetation. A few areas are in woodland.

If drained, this soil is fairly well suited to corn and small grains. The soil is well suited to shallow-rooted grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa, and the high water table and the ponding after heavy rains damage some crops. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability, the seasonal high water table, and instability limit the soil for most urban uses, especially as a site for waste disposal, buildings, and

local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 4C.

CeB—Caneadea silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and somewhat poorly drained. It is on lowlands and benches mainly near Muddy Creek, Slippery Rock Creek, and their tributaries. A few areas are near Connoquenessing Creek and Brush Creek. Slopes mainly are smooth. The areas are irregular in shape or long and narrow and range from 2 to 150 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence from the top, it is 5 inches of light olive brown, mottled silty clay loam; 11 inches of yellowish brown and grayish brown, mottled, firm silty clay and silty clay loam; and 36 inches of gray, mottled, firm silty clay and silty clay loam.

Included with this soil in mapping are a few areas of nearly level, sloping, and moderately steep Caneadea soils and soils similar to this Caneadea soil but that contain less clay in the subsoil and substratum or are moderately acid to very strongly acid throughout. Also included are small areas of Canadice, Fredon, Monongahela, Brinkerton, Ernest, Cavode, and Gresham soils.

The permeability of this Caneadea soil is slow. Runoff is slow to medium. In unlimed areas this soil is very strongly acid to moderately acid in the upper part and slightly acid to neutral in the lower part. The available water capacity is high, and the seasonal high water table is at a depth of 6 to 18 inches for long periods. Rooting depth is restricted by the seasonal high water table and by the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture or are in native vegetation. A few areas are in woodland.

This soil is fairly well suited to corn and small grains. The soil is well suited to shallow-rooted grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa, and the seasonal high water table after heavy rains damages some crops. Wetness delays plowing in the spring. Conservation tillage, cover crops, grasses and legumes in the cropping system, graded or contour stripcropping, and grassed waterways help to control runoff and erosion. Using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content, improve tilth, and reduce clodding and crusting.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability, the seasonal high water table, and instability limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 4C.

CeC—Caneadea silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and somewhat poorly drained. It is on foot slopes and benches, mainly in small areas near Muddy Creek, Slippery Rock Creek, and their tributaries. A few areas are along Connoquessing Creek and Brush Creek. Slopes are smooth or convex. The areas are long and narrow and range from 1 acre to 20 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence from the top, it is 5 inches of light olive brown, mottled silty clay loam; 11 inches of yellowish brown and grayish brown, mottled, firm silty clay and silty clay loam; and 36 inches of gray, mottled, firm silty clay and silty clay loam.

Included with this soil in mapping are a few areas of moderately steep and steep Caneadea soils and soils similar to this Caneadea soil but that are moderately acid to very strongly acid throughout, contain less clay in the subsoil, or have a fragipan. Also included are a few areas of Buchanan, Ernest, Gresham, Cavode, Brinkerton, Monongahela, Wharton, and Titusville soils.

The permeability of this Caneadea soil is slow. Runoff is medium to rapid, and the hazard of erosion is severe. In unlimed areas this soil is very strongly acid to moderately acid in the upper part and slightly acid to neutral in the lower part. The available water capacity is high, and the seasonal high water table is at a depth of 6 to 18 inches for long periods. Rooting depth is restricted by the seasonal high water table and by the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture or are in native vegetation. Some areas are in woodland.

This soil is fairly well suited to corn and small grains. The soil is well suited to shallow-rooted grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring. Using subsurface drains will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content, improve tilth, and reduce clodding and crusting. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and

legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

Slope, the slow permeability, the seasonal high water table, and instability limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4C.

CeD—Caneadea silt loam, 15 to 25 percent slopes. This soil is moderately steep, very deep, and somewhat poorly drained. It is on benches mostly along Slippery Rock Creek and its tributaries. Slopes are smooth or convex. The areas are long and narrow and range from 1 acre to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence from the top, it is 5 inches of light olive brown, mottled silty clay loam; 11 inches of yellowish brown and grayish brown, mottled, firm silty clay and silty clay loam; and 36 inches of gray, mottled, firm silty clay and silty clay loam. In areas where this soil has not been cultivated, the surface layer is black or very dark gray silt loam about 1 inch thick and the subsurface layer is grayish brown silt loam about 6 inches thick.

Included with this soil in mapping are a few small areas of sloping and very steep Caneadea soils. Also included are areas of Canadice, Fredon, Braceville, and Riverhead soils.

The permeability of this Caneadea soil is slow. Runoff is rapid, and the hazard of erosion is severe. In unlimed areas this soil is very strongly acid to moderately acid in the upper part and slightly acid to neutral in the lower part. The available water capacity is high, and the seasonal high water table is at a depth of 6 to 18 inches for long periods. Rooting depth is restricted by the seasonal high water table and by the firm part of the subsoil.

Most areas of this soil are used for woodland or are in native vegetation. A few areas are in pasture.

Slope and seasonal wetness make this soil poorly suited to corn and small grains, but the soil is fairly well suited to well suited to grasses and legumes that tolerate wetness. Contour stripcropping, grassed waterways, conservation tillage, and using mainly grasses and legumes in the cropping system will help reduce runoff and control erosion in cultivated areas. Subsurface drains will reduce wetness caused by seeps and springs. Mixing crop residue into the surface layer will help maintain organic matter content and reduce clodding and crusting.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removing undesirable species will help increase production. Slopes, the seasonal high water table, and instability of the soil limit the use of equipment for planting, managing, and harvesting trees.

Slope, the slow permeability, the seasonal high water table, and instability limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IVe; woodland ordination: 4C.

CIA—Cavode silt loam, 0 to 3 percent slopes. This soil is nearly level, deep, and somewhat poorly drained. It is on broad ridgetops and in depressions throughout the county. Slopes are smooth or concave. The areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping Cavode soils and soils similar to this Cavode soil but that contain more shale in the subsoil or have bedrock at a depth of less than 40 inches or more than 72 inches. Also included are small areas of Gilpin, Wharton, Ernest, Brinkerton, and Tilsit soils.

The permeability of this Cavode soil is slow. The seasonal high water table is at a depth of 6 to 18 inches for a major part of the year. Runoff is slow, and ponding is common in depressions during wet seasons. The available water capacity is moderate to high. In unlimed areas this soil is very strongly acid or strongly acid throughout. The rooting depth is restricted by the seasonal high water table and by the subsoil.

Most areas of this soil are used for cropland or pasture.

This soil is fairly well suited to corn and oats and is well suited to grasses and legumes that tolerate wetness. Wetness delays plowing and causes the soil to

warm up slowly in the spring. Wetness and frost heaving damage fall-sown grains and alfalfa during winter. Some crops are damaged by the seasonal high water table and the ponding after heavy rainfall. The use of surface and subsurface drainage where outlets are available helps to improve drainage. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 4W.

CIB—Cavode silt loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and somewhat poorly drained. It is on broad ridgetops and in depressions throughout the county. Slopes are smooth or concave. The areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of nearly level and strongly sloping Cavode soils and soils similar to this Cavode soil but that contain more shale in the subsoil or have bedrock at a depth of less than 40 inches or more than 72 inches. Also included are small areas of Gilpin, Wharton, Ernest, Brinkerton, Cookport, and Tilsit soils.

The permeability of this Cavode soil is slow. The seasonal high water table is at a depth of 6 to 18 inches for a major part of the year. Runoff is medium to slow, and ponding is common in depressions during wet seasons. The available water capacity is moderate to high. In unlimed areas this soil is very strongly acid or strongly acid throughout. The rooting depth is restricted by the seasonal high water table and by the subsoil.

Most areas of this soil are used for cropland or pasture. Some areas are in woodland.

This soil is fairly well suited to corn and oats and is well suited to grasses and legumes that tolerate wetness. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage fall-sown grains and alfalfa during winter. Some crops are damaged by the seasonal high water table and the ponding after heavy rainfall. The use of subsurface drainage where outlets are available helps to improve drainage. Contour stripcropping, conservation tillage, grassed waterways, cover crops, and grasses and legumes help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 4W.

CIC—Cavode silt loam, 8 to 15 percent slopes. This soil is strongly sloping, deep, and somewhat poorly drained. It is on ridgetops and side slopes throughout most of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping and moderately steep Cavode soils and soils similar to this Cavode soil but that contain more rock fragments, are underlain by bedrock at a depth of less than 40 inches, or contain less clay in the subsoil and substratum. Also included are small areas of Gilpin, Wharton, Cookport, Ernest, Tilsit, and Brinkerton soils.

The permeability of this Cavode soil is slow. The seasonal high water table is at a depth of 6 to 18 inches for a major part of the year. Runoff is medium to rapid. The available water capacity is moderate to high. In unlimed areas this soil is very strongly acid or strongly

acid throughout. The rooting depth is restricted by the seasonal high water table and by the subsoil.

Most areas of this soil are used for cropland, pasture, or woodland. Many areas that were farmed are reverting to brush and woodland.

This soil is fairly well suited to corn and oats and is well suited to grasses and legumes that tolerate wetness. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. Some crops are damaged by the seasonal high water table after heavy rainfall. The use of subsurface drainage where outlets are available helps to improve drainage. Contour stripcropping, conservation tillage, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and a severe erosion hazard. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

Slope, the permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4W.

CID—Cavode silt loam, 15 to 25 percent slopes. This soil is moderately steep, deep, and somewhat poorly drained. It is on hills and side slopes on uplands throughout most of the county. Slopes are convex or concave. The areas are long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of sloping and steep Cavode soils and soils similar to this Cavode soil but that contain more rock fragments, are underlain by bedrock at a depth of less than 40 inches, or contain less clay in the subsoil. Also included are small areas of Gilpin, Weikert, Wharton, Cookport, Ernest, and Vandergrift soils.

The permeability of this Cavode soil is slow. The seasonal high water table is at a depth of 6 to 18 inches for a major part of the year. Runoff is rapid. The available water capacity is moderate to high. In unlimed areas this soil is very strongly acid or strongly acid throughout. The rooting depth is restricted by the seasonal high water table and by the subsoil.

Most areas of this soil are used for pasture or woodland. Some areas are in cropland, and many areas that were farmed are reverting to brush and woodland.

Slope and seasonal wetness make this soil poorly suited to corn and small grains, but the soil is fairly well suited to well suited to grasses and legumes that tolerate wetness. Contour stripcropping, grassed waterways, conservation tillage, and using mainly grasses and legumes in the cropping system will help reduce runoff and control erosion in cultivated areas. Subsurface drains will reduce wetness caused by seeps and springs. Mixing crop residue into the surface layer will help maintain organic matter content and reduce to clodding and crusting.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table and slope restrict the use of equipment for much of the year, but machine planting is practical during dry periods.

Slope, the slow permeability, the seasonal high water table, and instability limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IVe; woodland ordination: 4W.

CmB—Clymer loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and well drained. It is on broad, undulating ridgetops throughout all but the extreme northwest part of the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is 30 inches thick. The upper 4 inches of the subsoil is dark yellowish brown loam. The next 10 inches is strong brown loam. The lower 16 inches is strong brown clay loam and channery clay loam. The substratum is strong brown extremely channery loam 6 inches thick. Fractured sandstone bedrock is at a depth of 44 inches.

Included with this soil in mapping are small areas of nearly level and strongly sloping Clymer soils and soils similar to this Clymer soil but that are dominantly silt loam throughout the surface layer and subsoil. Also included are small areas of Hazleton, Cookport, Gilpin, Wharton, Cavode, Buchanan, Tilsit, and Ernest soils.

The permeability of this Clymer soil is moderate, and runoff is medium. In unlimed areas this soil ranges from strongly acid to extremely acid throughout. The available water capacity is high to moderate.

Most areas of this soil are used for cropland.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. Conservation tillage, stripcropping, and grasses and legumes in the cropping system help to control runoff and erosion. Diversions are needed on some long slopes to reduce runoff. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of lime and fertilizer.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species will help increase production. Machine planting is practical on the larger areas.

This soil has a few limitations for most urban uses. The depth to bedrock is a limitation of the soil as a site for waste disposal and buildings with basements.

Capability subclass: IIe; woodland ordination: 4A.

CoA—Cookport loam, 0 to 3 percent slopes. This soil is nearly level, deep, and moderately well drained. It is on broad ridgetops throughout all but the northwest part of the county. Slopes are generally smooth. The areas are irregular in shape and range from 3 to 50 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is yellowish brown loam about 2 inches thick. The subsoil is 30 inches thick. The upper 15 inches of the subsoil is yellowish brown loam that is mottled in the lower part. The lower 15 inches is strong brown and dark yellowish brown, mottled, very firm and brittle loam and channery sandy loam. The substratum extends to a depth of 60 inches or more. It is brown and strong brown, mottled, very firm channery sandy loam and very channery and extremely channery loamy sand.

Included with this soil in mapping are small areas of gently sloping Cookport soils and soils similar to this Cookport soil but with silt loam in the upper part of the subsoil or that contain more rock fragments in the lower part of the subsoil. Also included are small areas of Clymer, Hazleton, Buchanan, Ernest, Wharton, Tilsit, Cavode, Andover, and Brinkerton soils.

The permeability of this Cookport soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is slow, and ponding in depressions is common during wet seasons. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is limited by the firm part of the subsoil.

Most areas of this soil are used for cropland or pasture.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Depressions and low areas remain wet after heavy rainfall. Subsurface drainage improves drainage and allows timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIw; woodland ordination: 4W.

CoB—Cookport loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and moderately well drained. It is on broad ridgetops throughout all but the northwest part of the county. Slopes are smooth, concave, or convex. The areas are irregular in shape and range from 2 to 100 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is yellowish brown loam about 2 inches thick. The subsoil is 30 inches thick. The upper 15 inches of the subsoil is yellowish brown loam that is mottled in the lower part. The lower 15 inches is strong brown and dark yellowish brown, mottled, very firm and brittle loam and channery sandy loam. The substratum extends to a depth of 60 inches or more. It is brown and strong brown, mottled, very firm channery sandy loam and very channery and extremely channery loamy sand.

Included with this soil in mapping are small areas of nearly level and strongly sloping Cookport soils and soils similar to this Cookport soil but with silt loam in the upper part of the subsoil or that contain more rock fragments in the lower part of the subsoil. Also included

are small areas of Clymer, Hazleton, Buchanan, Ernest, Wharton, Tilsit, Cavode, Andover, and Brinkerton soils

The permeability of this Cookport soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is medium, and ponding in depressions is common during wet seasons. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is limited by the firm part of the subsoil.

Most areas of this soil are used for crops, pasture, or woodland.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Depressions and low areas remain wet in spring after heavy rainfall. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Subsurface drainage improves drainage and allows timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIe; woodland ordination: 4W.

CoC—Cookport loam, 8 to 15 percent slopes. This soil is strongly sloping, deep, and moderately well drained. It is on ridgetops and side slopes throughout all but the northwest part of the county. Slopes are smooth, concave, or convex. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is yellowish brown loam about 2 inches thick. The subsoil is 30 inches thick. The upper 15 inches of the subsoil is yellowish brown loam that is mottled in the lower part. The lower 15 inches is strong brown and dark yellowish brown, mottled, very firm and brittle loam and channery sandy loam. The substratum extends to a depth of 60 inches or more. It is brown and strong brown, mottled, very firm channery sandy loam and very channery and extremely channery loamy sand.

Included with this soil in mapping are small areas of gently sloping and moderately steep Cookport soils and soils similar to this Cookport soil but with silt loam in the upper part of the subsoil, or that contain more rock fragments in the subsoil, or that are underlain by bedrock at a depth of less than 40 inches. Also included are small areas of Hazleton, Gilpin, Buchanan, Ernest, Wharton, Cavode, and Andover soils.

The permeability of this Cookport soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is rapid. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is limited by the firm part of the subsoil. The hazard of erosion is severe.

Most areas of this soil are used for crops, pasture, or woodland. Many areas that were farmed are reverting to brush and woodland.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. Subsurface drainage helps to prevent wetness near seeps and springs and allows timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

Slope, the slow and moderately slow permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4W.

CoD—Cookport loam, 15 to 25 percent slopes. This soil is moderately steep, deep, and moderately well drained. It is on hills and side slopes on uplands throughout all but the northwest part of the county. Slopes are smooth, concave, or convex. The areas are

irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is yellowish brown loam about 2 inches thick. The subsoil is 30 inches thick. The upper 15 inches of the subsoil is yellowish brown loam that is mottled in the lower part. The lower 15 inches is strong brown and dark yellowish brown, mottled, very firm and brittle loam and channery sandy loam. The substratum extends to a depth of 60 inches or more. It is brown and strong brown, mottled, very firm channery sandy loam and very channery and extremely channery loamy sand.

Included with this soil in mapping are small areas of sloping and steep Cookport soils and soils similar to this Cookport soil but with silt loam in the upper part of the subsoil, or that contain more rock fragments in the subsoil, or that are underlain by bedrock at a depth of less than 40 inches. Also included are small areas of Hazleton, Gilpin, Buchanan, Ernest, Wharton, Cavode, and Andover soils.

The permeability of this Cookport soil is moderate above the firm part of the subsoil, slow in the firm part of the subsoil, and moderately slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is rapid. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is limited by the firm part of the subsoil. The hazard of erosion is very severe.

Most areas of this soil are used for crops, pasture, or woodland. Many areas that were farmed are reverting to brush and woodland.

Slope and seasonal wetness make this soil generally poorly suited to corn and small grains, but the soil is well suited to grasses and legumes. Contour stripcropping, grassed waterways, conservation tillage, and cover crops and mainly grasses and legumes in the cropping system will help to reduce runoff and control erosion in cultivated areas. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Use of equipment is restricted by slope and by the seasonal high water table for brief periods during wet seasons. Machine planting on the larger areas is usually practical.

The permeability, the slope, and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IVe; woodland ordination: 4W.

Dd—Dumps, industrial waste. This unit is in a few areas throughout the county. Slopes range from nearly level to very steep, and they are smooth or complex. The areas are irregular in shape and range from 2 to 90 acres.

This unit consists mostly of slag, sludge, and other waste materials mainly from factories that produce steel, chemicals, and glass. In some areas the material is mixed with rock fragments and soil material. Some areas consist of stockpiles of ore, sand, coke, lime, and other materials used by those industries. The deposits are smooth, uneven, or in piles.

Included with this unit in mapping are small areas of Arents and Gilpin, Wharton, Cavode, Brinkerton, Ernest, and Atkins soils. Also included are a few sanitary landfills. Included areas make up about 20 percent of this unit.

Most of this unit is barren. A few areas have sparse stands of grasses, briars, and brush. Much of the unit is too toxic to support vegetation. Onsite investigation is needed to determine the potential and limitations of this unit for any use.

Capability subclass and woodland ordination: not assigned.

Dm—Dumps, mine. This unit is in a few areas throughout the county. Slopes range from nearly level to very steep, and they are smooth or complex. The areas are circular or irregular in shape and range from 2 to 35 acres.

This unit consists of areas of accumulation of waste material from coal mining. The material is pieces of coal and coal screenings, carbonaceous shale, and rock fragments mixed with some soil material. It typically is extremely acid. Most areas are near the entrance to small abandoned deep mines or at the site of active or abandoned coal tipples. Most of the waste material is in cone-shaped or long and narrow piles, but a few have been smoothed.

Included with this unit in mapping are small areas of Udorthents, Fluvaquents, and Arents and Ernest, Buchanan, Gilpin, Hazleton, Brinkerton, and Atkins soils. Included areas make up about 10 percent of this unit.

Most of this unit is barren. It is generally too acid to support vegetation. Onsite investigation is needed to determine the potential and limitations of the unit for any use.

Capability subclass and woodland ordination: not assigned.

ErB—Ernest silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and moderately well drained. It is on foot slopes, benches, and lowlands

throughout all but the northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is 47 inches thick and is mottled. The upper 15 inches of the subsoil is pale brown, friable to firm silt loam. The lower 32 inches is yellowish brown, very firm and brittle channery silty clay loam and channery silt loam. The substratum is brown, mottled, very firm channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of nearly level and sloping Ernest soils and soils similar to this Ernest soil but that contain more rock fragments throughout. Also included are a few areas of Buchanan, Cookport, Wharton, Cavode, Tilsit, Gilpin, Brinkerton, and Andover soils.

The permeability in this Ernest soil is moderate above the very firm part of the subsoil and moderately slow and slow in the very firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 30 inches during wet seasons. Runoff is slow to medium. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the very firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. Frost heaving and wetness damage some fall-sown small grains and alfalfa during winter. Conservation tillage, cover crops, grasses and legumes in the cropping system, stripcropping, diversions, and grassed waterways help to control erosion and reduce runoff. Diversions and subsurface drainage improve drainage and allow timely tillage.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve surface drainage.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting on the larger areas is usually practical.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIe; woodland ordination: 4W.

ErC—Ernest silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and moderately well drained. It is on foot slopes and benches throughout all but the northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is 47 inches thick and is mottled. The upper 15 inches of the subsoil is pale brown, friable to firm silt loam. The lower 32 inches is yellowish brown, very firm and brittle channery silty clay loam and channery silt loam. The substratum is brown, mottled, very firm channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping and moderately steep Ernest soils and soils similar to this Ernest soil but that contain more rock fragments throughout. A few areas are stony. Also included are small areas of Gilpin, Wharton, Cavode, Cookport, Buchanan, Brinkerton, and Andover soils.

The permeability in this Ernest soil is moderate above the very firm part of the subsoil and moderately slow and slow in the very firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 30 inches during wet seasons. Runoff is medium to rapid. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the very firm part of the subsoil.

Most areas of this soil are used for crops, pasture, or woodland. Some areas that were used for farmland are reverting to brush and woodland.

This soil is fairly well suited to corn and oats and is well suited to grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. Subsurface drainage helps to improve drainage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grass waterways help to control runoff and a severe hazard of erosion.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons. Machine planting is practical on the larger areas.

Slope, the permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4W.

Fc—Fluvaquents, coal overwash. This soil is nearly level, deep, and poorly drained and very poorly drained. It is on flood plains near coal mining operations in a few areas in the northern half of the county. Slopes are smooth. The areas are irregular in shape or long and narrow and range from 1 acre to 30 acres.

Sediments containing coal particles, pyrite, soil material, and rock fragments from active or abandoned deep mines, strip mines, coal tipples, and coal-washing facilities have been deposited by water on the surface of this soil. The makeup of soil is variable, but in many areas the surface layer is black, very dark gray, brown, or reddish brown channery silt loam or channery loam ranging from 6 to 24 inches thick. The substratum is stratified dark gray or dark grayish brown, mottled loamy material to a depth of at least 40 inches.

Included with this soil in mapping are areas of soils similar to these Fluvaquents but that are nearly level and gently sloping on benches and foot slopes. Also included are small areas of Dumps, mine, and Atkins, Brinkerton, Andover, Ernest, and Buchanan soils.

The permeability in these Fluvaquents is moderate to slow in the surface layer and moderately rapid to slow in the substratum. The available water capacity is high. Runoff is slow or very slow, and ponding and flooding are frequent. The high water table is at the surface for a major portion of the year. The surface layer is extremely acid, and the substratum ranges from strongly acid to extremely acid.

Most areas of these soils have a swampy vegetation of clumps of reeds, wetland grasses, and dead trees. Extreme acidity, wetness, and frequent flooding make these soils poorly suited to most uses.

Capability subclass and woodland ordination: not assigned.

FeA—Fredon loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and somewhat poorly drained and poorly drained. It is on outwash plains and in depressions dominantly in the northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 150 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 2 inches thick. The subsoil is light olive brown and grayish brown, mottled loam and sandy loam about 20 inches thick. The substratum extends to a depth of 60 inches or more. It is brown and yellowish brown, mottled, stratified loamy sand, sand, and gravel.

Included with this soil in mapping are small areas of gently sloping Fredon soils and soils similar to this Fredon soil but that contain more clay in the upper part of the subsoil or that have a weak fragipan. Also included are small areas of Atkins, Canadice, Caneadea, Frenchtown, Gresham, and Braceville soils. In some areas the surface layer is sandy loam or silt loam.

The permeability of this Fredon soil is moderate or moderately slow in the upper part of the subsoil and rapid in the lower part of the subsoil and in the substratum. The seasonal high water table is between the surface and a depth of 18 inches. Runoff is slow, and ponding occurs in depressions during wet seasons and following periods of heavy rainfall. The available water capacity ranges from high to moderate. This soil ranges from moderately acid to neutral above the substratum and from slightly acid to mildly alkaline in the substratum. Rooting depth is restricted by the seasonal high water table.

Most areas of this soil are used for pasture or are reverting to brush and woodland.

If drained, this soil is fairly well suited to corn, oats, and grasses and legumes. Wetness and frost heaving damage winter grains and alfalfa, and the high water table and the ponding after heavy rains damage some crops. Wetness delays plowing in the spring. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve drainage.

This soil is suited to trees, and potential productivity is moderate. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for part of the year.

The permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 3W.

FeB—Fredon loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and somewhat poorly drained and poorly drained. It is on outwash plains, foot slopes, and benches dominantly in the northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 100 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 2 inches thick. The subsoil is light olive brown and grayish brown, mottled loam and sandy loam about 20 inches thick. The substratum extends to a depth of 60 inches or more. It is brown and

yellowish brown, mottled, stratified loamy sand, sand, and gravel.

Included with this soil in mapping are a few areas of nearly level and strongly sloping Fredon soils and soils similar to this Fredon soil but that contain more clay in the upper part of the subsoil or that have a weak fragipan. Also included are small scattered areas of Atkins, Frenchtown, Caneadea, Braceville, and Gresham soils. In some areas the surface layer is sandy loam or silt loam.

The permeability of this Fredon soil is moderate or moderately slow in the upper part of the subsoil and rapid in the lower part of the subsoil and in the substratum. The seasonal high water table is between the surface and a depth of 18 inches. Runoff is slow or medium, and ponding occurs in depressions during wet seasons and following periods of heavy rainfall. The available water capacity ranges from high to moderate. This soil ranges from moderately acid to neutral above the substratum and from slightly acid to mildly alkaline in the substratum. Rooting depth is restricted by the seasonal high water table.

Most areas of this soil are used for pasture or are reverting to brush and woodland.

If drained, this soil is fairly well suited to corn and oats and to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring, and some crops are damaged by the water table and ponding after heavy rains. Keeping natural drainageways open, using surface drains, and using subsurface drains will help to alleviate wetness. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth. Contour stripcropping, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve drainage.

This soil is suited to trees, and potential productivity is moderate. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for part of the year.

The permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 3W.

FrA—Frenchtown silt loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and poorly drained. It is on lowlands and in depressions on glaciated till plains in the northwest part of the county. Slopes are smooth. The areas are irregular in shape and range from 2 to 25 acres.

Typically, the surface layer and subsurface layer are dark grayish brown silt loam and have a combined thickness of about 12 inches. The subsoil extends to a depth of 60 inches or more. The upper 5 inches of the subsoil is grayish brown, mottled, firm silt loam. Below that, the subsoil is grayish brown and olive brown, mottled, very firm and brittle silt loam, loam, and gravelly loam.

Included with this soil in mapping are small areas of gently sloping Frenchtown soils and soils similar to this Frenchtown soil but that contain more sand or gravel throughout or that do not have a fragipan. Also included are areas of Atkins, Canadice, Caneadea, Fredon, Braceville, Gresham, and Brinkerton soils.

The permeability of this Frenchtown soil is moderate above the lower part of the subsoil and slow and moderately slow in the lower part of the subsoil. The high water table is between the surface and a depth of 12 inches for a major portion of the year. Runoff is slow, and ponding is common in depressions during wet seasons and following periods of heavy rainfall. The available water capacity is moderate. In unlimed areas this soil is moderately acid to very strongly acid in the upper part, slightly acid to strongly acid in the middle part, and moderately acid to mildly alkaline in the lower part. Rooting depth is restricted by the high water table and by the lower part of the subsoil.

Most areas of this soil are used for pasture and woodland. A few areas are used for crops. Many areas that were farmed are reverting to brush and woodland.

Unless drained, this soil is poorly suited to corn, vegetables, fruit, and small grains. The soil is fairly well suited to grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring, and crops are frequently damaged by ponding and the water table after heavy rainfall. Keeping natural drainageways open, using surface drains, and using subsurface drains where outlets are available will help to alleviate wetness.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, plants that tolerate wetness, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open and using surface and subsurface drainage will improve internal drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 5W.

FrB—Frenchtown silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and poorly drained. It is on broad lowlands, foot slopes, and benches on glaciated till plains in the northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 2 to 150 acres.

Typically, the surface layer and subsurface layer are dark grayish brown silt loam and have a combined thickness of about 12 inches. The subsoil extends to a depth of 60 inches or more. The upper 5 inches of the subsoil is grayish brown, mottled, firm silt loam. Below that, the subsoil is grayish brown and olive brown, mottled, very firm and brittle silt loam, loam, and gravelly loam.

Included with soil in mapping are small areas of nearly level Frenchtown soils and soils similar to this Frenchtown soil but that contain more sand or gravel throughout or that do not have a fragipan. Also included are areas of Canadice, Caneadea, Brinkerton, Gresham, Titusville, Fredon, and Braceville soils.

The permeability of this Frenchtown soil is moderate above the lower part of the subsoil and slow and moderately slow in the lower part of the subsoil. The high water table is between the surface and a depth of 12 inches for a major portion of the year. Runoff is slow to medium, and ponding is common in depressions during wet seasons and following periods of heavy rainfall. The available water capacity is moderate. In unlimed areas this soil is moderately acid to very strongly acid in the upper part, slightly acid to strongly acid in the middle part, and moderately acid to mildly alkaline in the lower part. Rooting depth is restricted by the high water table and by the lower part of the subsoil.

Most areas of this soil are used for pasture or woodland. A few areas are used for cropland. Many areas that were farmed are reverting to brush and woodland.

If drained, this soil is fairly well suited to corn, small grains, and grasses and legumes that tolerate wetness. Wetness and frost heaving damage winter grains and alfalfa. Wetness delays plowing in the spring and causes the soil to warm slowly in spring. Keeping natural drainageways open and using surface and subsurface drains where outlets are available will help to alleviate wetness. Contour stripcropping, diversions, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will help to reduce runoff and control erosion.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, plants that tolerate wetness, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open and using surface and subsurface drainage will improve internal drainage.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The high water table restricts the use of equipment for much of the year, but machine planting is practical during dry periods.

The slow permeability and the high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 5W.

GlB—Gilpin silt loam, 3 to 8 percent slopes. This soil is gently sloping, moderately deep, and well drained. It is on ridgetops throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 2 to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

Included with this soil in mapping are small areas of nearly level and strongly sloping Gilpin soils and soils similar to this Gilpin soil but that contain more rock fragments in the subsoil, have a substratum at a depth of more than 36 inches, or are underlain by bedrock at a depth of more than 40 inches. Also included are small areas of Weikert, Hazleton, Clymer, Wharton, Tilsit, Ernest, and Upshur soils.

The permeability of this Gilpin soil is moderate, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout. The hazard of erosion is moderate. Runoff is medium. The rooting depth is restricted by the bedrock.

Most areas of this soil are used for crops and pasture. A few areas are in woodland.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. If the soil is used for cultivated crops, erosion will result in a shallower rooting depth and lower available water capacity for plants. Stripcropping, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system help to reduce runoff and control erosion. Where the topography is suitable, contour stripcropping also helps to control erosion. Incorporating

crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. The rooting depth is restricted by bedrock at a depth of 20 to 40 inches. Removing undesirable species will help increase production. Machine planting on large areas is generally practical.

The depth to bedrock, slope, and shale in the soil limit the soil for some urban uses. The depth to bedrock especially limits the soil as a site for waste disposal and buildings with basements. If this soil is disturbed for construction, management practices are needed to control erosion and sedimentation.

Capability subclass: IIe; woodland ordination: 4A.

GlC—Gilpin silt loam, 8 to 15 percent slopes. This soil is strongly sloping, moderately deep, and well drained. It is on ridges and side slopes throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

Included with this soil in mapping are small areas of gently sloping and moderately steep Gilpin soils and soils similar to this Gilpin soil but that contain more rock fragments in the subsoil, have a substratum at a depth of more than 36 inches, or are underlain by bedrock at a depth of more than 40 inches. Also included are small areas of Weikert, Hazleton, Clymer, Wharton, Tilsit, Ernest, and Upshur soils.

The permeability of this Gilpin soil is moderate, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout. The hazard of erosion is severe. Runoff is medium to rapid. The rooting depth is restricted by the bedrock.

Most areas of this soil are used for crops and pasture. A few areas are in woodland.

This soil is well suited to corn, small grains, grasses and legumes. If the soil is used for cultivated crops, erosion will result in a shallower rooting depth and lower available water capacity for plants. Stripcropping, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system help to reduce runoff and control erosion. Where the topography is suitable, diversions can be used to control runoff on long slopes. Incorporating crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. The rooting depth is restricted by bedrock at a depth of 20 to 40 inches. Removing undesirable species will help increase production. Machine planting on large areas is generally practical.

The depth to bedrock, slope, and shale in the soil limit the soil for some urban uses. The depth to bedrock especially limits the soil as a site for waste disposal and buildings with basements. If this soil is disturbed for construction, management practices are needed to control erosion and sedimentation.

Capability subclass: IIIe; woodland ordination: 4A.

GmD—Gilpin channery silt loam, 15 to 25 percent slopes. This soil is moderately steep, moderately deep, and well drained. It is on hills and side slopes on uplands throughout the county. Slopes are convex. The areas are long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

Included with this soil in mapping are small areas of sloping and steep Gilpin soils and soils similar to this Gilpin soil but that contain more rock fragments throughout. Also included are small areas of Weikert, Hazleton, Wharton, Cookport, Cavode, Ernest, and Upshur soils.

The permeability of this Gilpin soil is moderate, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout. Runoff is rapid. The hazard of erosion is very severe. The rooting depth is restricted by the bedrock.

Most areas of this soil are used for crops and pasture. Many areas that were farmed are reverting to brush and woodland.

This soil is poorly suited to corn and small grains because of slope and the hazard of erosion. The soil is fairly well suited to well suited to drought-resistant grasses and legumes. If the soil is used for cultivated crops, erosion will result in a shallower rooting depth and lower available water capacity for plants. Contour stripcropping, grassed waterways, conservation tillage, and the use of cover crops and mainly grasses and legumes in the cropping system will help to reduce runoff and control erosion. Incorporating crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is fairly well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. The rooting depth is restricted by bedrock at a depth of 20 to 40 inches. Removing undesirable species will help increase production. Slope limits the use of equipment for planting, maintenance, and harvesting.

Slope and the depth to bedrock limit this soil as a site for most urban uses, especially waste disposal and buildings, streets, and roads. If this soil is disturbed for construction, management practices will be needed to control erosion and sedimentation. In urban areas this soil is suitable for grasses, shrubs, and trees used in wildlife habitat, undeveloped recreation areas, and other open-space areas.

Capability subclass: IVe; woodland ordination: 4R.

GnC—Gilpin-Upshur complex, 8 to 15 percent slopes. This unit consists of strongly sloping, moderately deep and deep, well drained soils on ridges, side slopes, and benches dominantly in the southern half of the county. Slopes mainly are smooth or concave, and slips or landslides are common. The areas are irregular in shape or long and narrow and range from 1 acre to 10 acres. The Gilpin and Upshur soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 50 percent of this unit. Typically, they have a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Upshur soils make up about 30 percent of this unit. Typically, the surface layer is dark brown silty clay loam about 6 inches thick. The subsoil is reddish brown, firm clay about 28 inches thick. The substratum is 43 inches thick. It is dusky red, firm to friable channery to extremely channery clay to silty clay loam. Dusky red weathered shale bedrock is at a depth of about 77 inches.

Included with these soils in mapping are small areas of nearly level, gently sloping, and moderately steep Gilpin and Upshur soils; soils similar to the Gilpin soils but that contain more clay in the surface layer and subsoil; and soils similar to the Upshur soils but that are mottled in the lower part of the subsoil. Also included are a few areas of Wharton, Cavode, Weikert, Tilsit, and Vandergrift soils. Included soils make up about 20 percent of the unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Upshur soils have slow permeability and moderate to high available water capacity. Runoff is medium to rapid on both soils. The hazard of erosion is moderate to severe on the Gilpin soils and severe or very severe on the Upshur soils. In unlimed areas the Gilpin soils are strongly acid to extremely acid, and the Upshur soils are very strongly acid to slightly acid in the surface layer and subsoil and strongly acid to moderately alkaline in the substratum. Rooting depth is restricted by the bedrock in the Gilpin soils and by the firmness of the subsoil and substratum in the Upshur soils. The Upshur soils have a high shrink-swell potential. They are unstable and are subject to slips and landslides.

Most areas of these soils are used for crops or pasture. A few areas are in woodland.

These soils are fairly well suited to corn and small grains and well suited to grasses and legumes. If the soils are used for cultivated crops, erosion results in a shallower rooting depth and lower available water capacity for plants. Conservation tillage, winter cover crops, contour stripcropping, grassed waterways, and crop rotations dominated by use of grasses and legumes help to reduce runoff and control erosion. Incorporating crop residue into the surface layer will help maintain organic matter content, increase water infiltration, and reduce the tendency of the Upshur soils to clod and crust.

These soils are well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs.

These soils are suited to trees. Potential productivity is moderately high for the Gilpin soils and moderate for the Upshur soils. The bedrock in the Gilpin soils and the firmness of the subsoil and substratum in the Upshur soils restrict the rooting depth. Removing undesirable species will help increase production. The unstable clayey soil limits the use of equipment on the Upshur soils, but machine planting on large areas is generally practical.

The bedrock in the Gilpin soils and the permeability and shrink-swell potential of the Upshur soils limit the unit for most urban uses, especially as a site for waste disposal and buildings, streets, and roads. If the Upshur soils are disturbed for construction, they are unstable and are subject to slips and landslides, and management is needed to control erosion and increase stability. In urban areas these soils are suitable for grass, shrubs, and trees used in wildlife habitat, undeveloped recreation areas, and other open-space areas.

Capability subclass: IVe; woodland ordination: 4A for the Gilpin part and 3C for the Upshur part.

GnD—Gilpin-Upshur complex, 15 to 30 percent slopes. This unit consists of moderately steep and steep, moderately deep and deep, well drained soils on hillsides and benches dominantly in the southern half of the county. Slopes are mainly smooth or concave, and

slips or landslides are common. The areas are irregular in shape or long and narrow and range from 1 acre to 25 acres. The Gilpin and Upshur soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 55 percent of this unit. Typically, they have a surface layer of dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Upshur soils make up about 25 percent of this unit. Typically, the surface layer is dark brown silty clay loam about 6 inches thick. The subsoil is reddish brown, firm clay about 28 inches thick. The substratum is 43 inches thick. It is dusky red, firm to friable channery to extremely channery clay to silty clay loam. Dusky red weathered shale bedrock is at a depth of about 77 inches.

Included with these soils in mapping are small areas of sloping and very steep Gilpin and Upshur soils, soils similar to the Gilpin soils but that contain more clay in the surface layer and subsoil, and soils similar to the Upshur soils but that are mottled in the subsoil or that have bedrock at a depth of less than 40 inches. Also included are small areas of Wharton, Cavode, Weikert, Tilsit, and Vandergrift soils. Included soils make up about 20 percent of the unit.

The Gilpin soils have moderate permeability and moderate to low available water capacity. The Upshur soils have slow permeability and moderate to high available water capacity. Runoff is rapid on both soils, and the hazard of erosion is very severe. In unlimed areas the Gilpin soils are strongly acid to extremely acid throughout, and the Upshur soils are very strongly acid to slightly acid in the surface layer and subsoil and very strongly acid to moderately alkaline in the substratum. Rooting depth is restricted by the bedrock in the Gilpin soils and by the firmness of the subsoil and substratum in the Upshur soils. The Upshur soils have a high shrink-swell potential. They are unstable and are subject to slips and landslides.

Most areas of these soils are used for crops and pasture.

These soils are poorly suited to cultivated crops but are fairly well suited to grasses and legumes for permanent hay and pasture. If the soils are used for pasture, proper stocking rates and rotation grazing are the chief management needs.

These soils are suited to trees. Potential productivity is moderately high for the Gilpin soils and moderate for the Upshur soils. The bedrock in the Gilpin soils and the firmness of the subsoil and substratum in the Upshur soils limit the rooting depth. Removing undesirable species will increase production. Slope, instability, and the hazard of erosion limit the use of equipment for planting, managing, and harvesting.

Slope, the bedrock in the Gilpin soils, and the permeability and shrink-swell potential in the Upshur soils limit the unit for most urban uses, especially as a site for waste disposal and buildings, streets, and roads. The Upshur soils are unstable and are subject to slips and landslides. If they are disturbed for construction, management will be needed to control erosion and sedimentation and to increase stability. In urban areas the soils are suitable for grass, shrubs, and trees used in wildlife habitat, undeveloped recreation areas, and other open-space areas.

Capability subclass: IVe; woodland ordination: 4R for the Gilpin part and 3C for the Upshur part.

GoB—Gilpin-Weikert channery silt loams, 3 to 8 percent slopes. This unit consists of gently sloping, moderately deep and shallow, well drained soils on undulating uplands and ridges throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 25 acres. The Gilpin and Weikert soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 50 percent of this unit. Typically, they have a surface layer of dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Weikert soils make up about 35 percent of this unit. Typically, they have a surface layer of dark brown channery silt loam about 6 inches thick. The subsoil is yellowish brown very channery silt loam about 7 inches thick. The substratum is yellowish brown extremely channery silt loam 3 inches thick. Fractured siltstone bedrock is at a depth of about 16 inches.

Included with these soils in mapping are small areas of nearly level and sloping Gilpin and Weikert soils and areas of Wharton, Tilsit, Cavode, and Hazleton soils. Also included are a few areas of soils that contain more sand than these Gilpin and Weikert soils. Included soils make up about 15 percent of the unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Weikert soils have moderately rapid permeability and very low available water capacity. Runoff is medium on both soils. In unlimed areas the Gilpin and Weikert soils are strongly acid to extremely acid throughout. The rooting depth is restricted by the bedrock in both soils.

Most areas of these soils are used for cropland or are in native vegetation. Some areas are in pasture and woodland.

These soils are fairly well suited to corn and small grains, but yields are likely to be low during periods of low rainfall. If these soils are used for cultivated crops, a moderate erosion hazard will result in a shallower rooting depth and lower available water capacity for plants. Stripcropping, grassed waterways, conservation tillage, cover crops, and dominant use of grasses and legumes in the crop rotation will help to reduce runoff and erosion. Where the topography is suitable, contour stripcropping helps to control erosion. Incorporating crop residue into the surface layer will help maintain the organic matter content and improve tilth.

These soils are fairly well suited to pasture plants, especially to shallow-rooting, drought-resistant grasses and legumes. Stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

These soils are suited to trees. Potential productivity is moderate for the Weikert soils and moderately high for the Gilpin soils. Rooting depth is restricted by bedrock at a depth of 10 to 40 inches. The available water capacity in the Weikert soils causes a high rate of seedling mortality. Removing undesirable species is a main management practice. Machine planting on large areas is generally practical.

The depth to bedrock is the main limitation of the unit as a site for most urban uses, especially waste disposal and buildings with basements. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation.

Capability subclass: IIIe; woodland ordination: 4A for the Gilpin part and 3D for the Weikert part.

GoC—Gilpin-Weikert channery silt loams, 8 to 15 percent slopes. This unit consists of strongly sloping, moderately deep and shallow, well drained soils on rolling uplands and hillsides throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 2 to 50 acres. The Gilpin and Weikert soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 50 percent of this unit. Typically, they have a surface layer of dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Weikert soils make up about 35 percent of this unit. Typically, they have a surface layer of dark brown channery silt loam about 6 inches thick. The subsoil is yellowish brown very channery silt loam about 7 inches thick. The substratum is yellowish brown extremely channery silt loam 3 inches thick. Fractured siltstone bedrock is at a depth of about 16 inches.

Included with these soils in mapping are a few small areas of gently sloping and moderately steep Gilpin and Weikert soils and areas of Hazleton, Wharton, Ernest, and Cavode soils. In a few areas bedrock is less than 10 inches below the surface. Also included are small areas of soils that contain more sand than these Gilpin and Weikert soils. Included soils make up about 15 percent of this unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Weikert soils have moderately rapid permeability and very low available water capacity. Runoff is rapid, and the hazard of erosion is severe on both soils. In unlimed areas the Gilpin and Weikert soils are strongly acid to extremely acid throughout. The rooting depth is restricted by the bedrock in both soils.

Most areas of these soils are used for cropland or are in native vegetation. Some areas are in pasture and woodland.

These soils are fairly well suited to poorly suited to corn and small grains. Because of the moderate to very low available water capacity, yields are likely to be low during periods of low rainfall. If these soils are used for cultivated crops and small grains, the moderate to severe erosion hazard will result in shallower rooting depth and lower available water capacity for plants. Contour stripcropping, grassed waterways, conservation tillage, cover crops, and a crop rotation that uses mainly grasses and legumes will help to reduce runoff and control erosion. Incorporating crop residue into the surface layer will help to maintain the organic matter content and improve tilth.

These soils are fairly well suited or well suited to pasture plants, especially shallow-rooting, drought resistant grasses and legumes. Proper stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

These soils are suited to trees. Potential productivity is moderate for the Weikert soils and moderately high for the Gilpin soils. Rooting depth is restricted by bedrock at a depth of 10 to 40 inches. The available water capacity in the Weikert soils causes a high rate of seedling mortality. Removing undesirable species is a main management practice. Machine planting on large areas is generally practical.

Slope and the depth to bedrock limit the soils as a site for many urban uses, especially waste disposal and buildings with basements. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation.

Capability subclass: IVe; woodland ordination: 4A for the Gilpin part and 3D for the Weikert part.

GoD—Gilpin-Weikert channery silt loams, 15 to 25 percent slopes. This unit consists of moderately steep, moderately deep and shallow, well drained soils on

hillsides and side slopes on rolling uplands throughout the county. Slopes are smooth or convex. The areas are mainly long and narrow and range from 1 acre to 50 acres. The Gilpin and Weikert soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 50 percent of this unit. Typically, they have a surface layer of dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Weikert soils make up about 40 percent of this unit. Typically, they have a surface layer of dark brown channery silt loam about 6 inches thick. The subsoil is yellowish brown very channery silt loam about 7 inches thick. The substratum is yellowish brown extremely channery silt loam 3 inches thick. Fractured siltstone bedrock is at a depth of about 16 inches.

Included with these soils in mapping are a few small areas of strongly sloping and steep Gilpin and Weikert soils and areas of Hazleton, Wharton, Ernest, and Cavode soils. Some areas have a few stones on the surface, and in places shale bedrock is at a depth of less than 10 inches or outcrops at the surface. In a few areas the soils contain more sand throughout than these Gilpin and Weikert soils. Included soils make up about 10 percent of the unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Weikert soils have moderately rapid permeability and very low available water capacity. Runoff is very rapid, and the hazard of erosion is very severe on both soils. In unlimed areas the Gilpin and Weikert soils are strongly acid to extremely acid throughout. The rooting depth is restricted by the bedrock in both soils.

Most areas of these soils are used for pasture and woodland or are in native vegetation.

These soils are poorly suited to corn and small grains because of the available water capacity, erosion hazard, slope, and depth to bedrock. They are fairly well suited to shallow-rooting grasses and legumes used for permanent hay or pasture. If the soils are used for pasture, proper stocking rates and rotation grazing are the chief management needs.

These soils are suited to trees. Potential productivity is moderate for the Weikert soils and moderately high for the Gilpin soils. Rooting depth is restricted by bedrock at a depth of 10 to 40 inches. The available water capacity in the Weikert soils causes a high rate of seedling mortality. Removing undesirable species is a main management practice. Slope limits the use of equipment for planting, managing, and harvesting trees.

Slope and the depth to bedrock limit the soils as a site for most urban uses, especially waste disposal, buildings, and local roads and streets. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation. These soils are suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: VIe; woodland ordination: 4R for the Gilpin part and 3D for the Weikert part.

GoF—Gilpin-Weikert channery silt loams, 25 to 70 percent slopes. This unit consists of steep and very steep, moderately deep and shallow, well drained soils on hillsides and side slopes on uplands throughout the county. Slopes are smooth or convex. The areas are long and narrow and range from 1 acre to 100 acres. The Gilpin and Weikert soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 45 percent of this unit. Typically, they have a surface layer of very dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is brown or yellowish brown channery silt loam about 6 inches thick. The subsoil is yellowish brown very channery silt loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam about 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches. If the soil is cultivated, the surface layer is dark grayish brown channery silt loam about 6 inches thick.

The Weikert soils make up about 40 percent of this unit. Typically, they have a surface layer of very dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is brown or yellowish brown channery or very channery silt loam about 5 inches thick. The subsoil is yellowish brown very channery silt loam about 7 inches thick. The substratum is yellowish brown extremely channery silt loam 2 inches thick. Fractured siltstone bedrock is at a depth of about 16 inches. If the soil is cultivated, the surface layer is dark brown channery or very channery silt loam about 6 inches thick.

Included with these soils in mapping are small areas of moderately steep Gilpin and Weikert soils and areas of Hazleton, Ernest, Buchanan, and Wharton soils. Some areas have a few stones on the surface, and in places bedrock is at a depth of less than 10 inches or outcrops at the surface. Also included are a few escarpments. Included areas make up about 15 percent of the unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Weikert soils have moderately rapid permeability and very low available water capacity. Runoff is very rapid, and the hazard of erosion is very severe on both soils. In unlimed areas the Gilpin and Weikert soils are strongly acid to extremely acid throughout. The rooting depth is restricted by the bedrock in both soils.

Most areas of these soils are used for woodland or are in native vegetation. A few areas are used for pasture.

Slope makes these soils generally unsuited to crops and poorly suited to pasture. The soils are suited to trees. Potential productivity is moderate for the Weikert soils and moderately high for the Gilpin soils. The rooting depth is restricted by bedrock, and the available water capacity causes a high rate of seedling mortality. Slope limits the use of equipment for planting and harvesting trees.

Slope and the depth to bedrock limit the soils as a site for most urban uses. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation. These soils are suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: VIIe; woodland ordination: 4R for the Gilpin part and 3D for the Weikert part.

GpC—Gilpin-Wharton silt loams, 8 to 15 percent slopes. This unit consists of deep, moderately well drained Wharton soils and moderately deep, well drained Gilpin soils. It is on strongly sloping, rolling uplands and hillsides throughout the county. Slopes are smooth, concave, or convex. The areas are irregular in shape or long and narrow and range from 2 to 100 acres. The Gilpin and Wharton soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 60 percent of this unit. Typically, they have a surface layer of grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches.

The Wharton soils make up about 30 percent of this unit. Typically, they have a surface layer of dark grayish brown silt loam about 9 inches thick. The subsoil is 37 inches thick. The upper 13 inches of the subsoil is yellowish brown, friable silt loam containing mottles in the lower part. The next 9 inches is brown, mottled silt loam that is friable in the upper part and firm in the lower part. The lower 15 inches is dark yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, very firm channery silty clay loam 23 inches thick. Fractured shale bedrock is at a depth of about 69 inches.

Included with these soils in mapping are small areas of gently sloping and moderately steep Gilpin and Wharton soils and soils similar to the Wharton soils but that contain more shale throughout and have bedrock at a depth of less than 40 inches. Also included are small areas of Weikert, Hazleton, Ernest, Buchanan, and Cavode soils. Included soils make up about 10 percent of this unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Wharton soils have moderately slow or slow permeability, a seasonal high water table at a depth of 18 to 36 inches, and high available water capacity. On both soils runoff is rapid and the hazard of erosion is severe. In unlimed areas the Gilpin soils are strongly acid to extremely acid throughout; the Wharton soils are strongly acid or very strongly acid in the subsoil and strongly acid to extremely acid in the substratum. The rooting depth is restricted by shale bedrock.

Most areas of these soils are used for crops and pasture. Some areas are in woodland or native vegetation.

These soils are fairly well suited to corn and other cultivated crops and small grains. They are well suited to shallow-rooting grasses and legumes. Frost heaving and wetness damage some fall-sown grains and alfalfa during winter. Conservation tillage, cover crops, a crop rotation dominated by grasses and legumes, contour stripcropping, diversions, and grassed waterways will help to control runoff and erosion. Subsurface drains are needed in some areas to remove excess water and to allow timely tillage. Incorporating crop residue into the surface layer will help to maintain organic matter content, increase water infiltration, and reduce clodding and crusting.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

These soils are suited to trees. Potential productivity is moderately high. Rooting depth is restricted by the shale bedrock in some areas in the Gilpin soils and by the seasonal high water table in the Wharton soils. Removing undesirable species is a main management practice. Wetness restricts the use of equipment for brief periods, but machine planting is practical on the larger areas.

Slope is a major limitation of this unit for most urban uses. The other major limitations are the seasonal high water table and permeability in the Wharton soils and the depth to bedrock in the Gilpin soils. All of those are limitations of the unit as a site for waste disposal or buildings with basements. If buildings are constructed on these soils, foundation drains with proper outlets are needed to prevent seepage of water into basements. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation.

Capability subclass: IIIe; woodland ordination: 4A for the Gilpin part and 4R for the Wharton part.

GpD—Gilpin-Wharton complex, 15 to 25 percent slopes. This unit consists of deep, moderately well drained Wharton soils and moderately deep, well drained Gilpin soils. It is on moderately steep hillsides and side slopes on rolling uplands throughout the county. Slopes are smooth, concave, or complex. The areas are

irregular in shape or long and narrow and range from 2 to 100 acres. Gilpin and Wharton soils are in such an intricate pattern that it was impractical to map them separately.

The Gilpin soils make up about 60 percent of this unit. Typically, they have a surface layer of dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam or silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches. In areas that have not been plowed the surface layer is very dark grayish brown channery silt loam about 2 inches thick and the subsurface layer is grayish brown channery silt loam about 5 inches thick.

The Wharton soils make up about 25 percent of this unit. Typically, they have a surface layer of dark grayish brown silt loam about 9 inches thick. The subsoil is 37 inches thick. The upper 13 inches of the subsoil is yellowish brown, friable silt loam containing mottles in the lower part. The next 9 inches is brown, mottled silt loam that is friable in the upper part and firm in the lower part. The lower 15 inches of the subsoil is dark yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, channery silty clay loam 23 inches thick. Fractured shale bedrock is at a depth of about 69 inches. In areas that have not been plowed the surface layer is very dark grayish brown silt loam about 2 inches thick and the subsurface layer is brown or yellowish brown silt loam about 6 inches thick.

Included with these soils in mapping are small areas of sloping and steep Gilpin and Wharton soils and soils similar to the Wharton soils but that contain more shale throughout and have bedrock at a depth of less than 40 inches. Also included are areas of Weikert, Hazleton, Cavode, Ernest, Buchanan, Cookport, Vandergift, and Upshur soils. Included soils make up about 15 percent of this unit.

The Gilpin soils have moderate permeability and moderate available water capacity. The Wharton soils have moderately slow or slow permeability, a seasonal high water table at a depth of 18 to 36 inches, and high available water capacity. On both soils runoff is very rapid or rapid and the hazard of erosion is very severe. In unlimed areas the Gilpin soils are strongly acid to extremely acid throughout; the Wharton soils are strongly acid or very strongly acid in the subsoil and strongly acid to extremely acid in the substratum. The rooting depth is restricted by shale bedrock.

Most areas of these soils are used for pasture and woodland or are in native vegetation.

These soils are poorly suited to corn and small grains and fairly well suited or well suited to shallow-rooting grasses and legumes. If the soils are used for cultivated crops or small grains, conservation tillage, cover crops, a crop rotation that uses mainly grasses and legumes, contour stripcropping, diversions, and grassed waterways help to reduce runoff and control erosion (fig. 9). Incorporating crop residue into the surface layer will help to maintain organic matter content, increase water infiltration, and reduce clodding and crusting.

These soils are suited to pasture. Proper stocking rates, rotation grazing, and restricting grazing during wet periods will help to keep the pasture and soils in good condition.

These soils are suited to trees. Potential productivity is moderately high. Rooting depth is restricted by the shale bedrock in some areas in the Gilpin soils and by the seasonal high water table in the Wharton soils. Removing undesirable species is a main management practice. Slope limits the use of equipment, but machine planting on large areas is generally practical.

Slope is a major limitation of this unit for most urban uses. The other major limitations are the seasonal high water table and permeability in the Wharton soils and the depth to bedrock in the Gilpin soils. All of those are limitations of the unit as a site for waste disposal, buildings, and local roads and streets. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation.

Capability subclass: IVe; woodland ordination: 4R.

GrA—Gresham silt loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and somewhat poorly drained. It is on smooth and undulating uplands in the northwest part of the county. Slopes are mainly smooth. The areas are irregular in shape and range from 1 acre to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is mottled and extends to a depth of at least 75 inches. The upper 13 inches of the subsoil is yellowish brown, strong brown, and grayish brown, friable silt loam. The next 18 inches is brown, firm and brittle silt loam. The lower 36 inches is strong brown and yellowish brown, firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of gently sloping Gresham soils and areas of soils similar to this Gresham soil but that have more rock fragments in the upper part. Also included are small areas of Titusville, Frenchtown, Fredon, and Braceville soils.

The permeability of this Gresham soil is moderate and moderately slow above the firm part of the subsoil and slow in the firm part. The seasonal high water table is at a depth of 6 to 18 inches. Runoff is slow, and ponding sometimes occurs in depressions during wet seasons. The available water capacity is moderate. In unlimed areas this soil is extremely acid to strongly acid to a depth of 40 inches, strongly acid or moderately acid between depths of 40 and 60 inches, and neutral or mildly alkaline at a depth of more than 60 inches. Rooting depth is restricted by the firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

Figure 9.—Contour strips on Gilpin-Wharton complex, 15 to 25 percent slopes.

This soil is fairly well suited to corn and small grains. The soil is well suited to grasses and legumes. Wetness and frost heaving damage fall-sown grains and alfalfa during winter, and the high water table and the ponding after heavy rains damage some crops. Wetness in the spring delays plowing and causes the soil to warm slowly. Using subsurface drains where outlets are available will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment during wet periods, but machine planting is usually practical during dry periods.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass: IIIw; woodland ordination: 4W.

GrB—Gresham silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and somewhat poorly drained. It is on undulating uplands in the northwest part of the county. Slopes are smooth, convex, or concave. The areas are irregular in shape and range from 2 to 200 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is mottled and extends to a depth of at least 75 inches. The upper 13 inches of the subsoil is yellowish brown, strong brown, and grayish brown, friable silt loam. The next 18 inches is brown, firm and brittle silt loam. The lower 36 inches is

strong brown and yellowish brown, firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of nearly level and sloping Gresham soils and soils similar to this Gresham soil but that have more rock fragments throughout the upper part. Also included are small areas of Titusville, Frenchtown, Fredon, Riverhead, Wheeling, and Braceville soils.

The permeability of this Gresham soil is moderate and moderately slow above the firm part of the subsoil and slow in the firm part. The seasonal high water table is at a depth of 6 to 18 inches. Runoff is slow or medium. The available water capacity is moderate. In unlimed areas this soil is extremely acid to strongly acid to a depth of 40 inches, strongly acid or moderately acid between depths of 40 and 60 inches, and neutral or mildly alkaline at a depth of more than 60 inches. Rooting depth is restricted by the firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage where outlets are available helps to improve drainage and allow timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and maintain tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment during wet periods, but machine planting is usually practical during dry periods.

The slow permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. This soil is suitable for wildlife habitat, some recreation uses, and grasses and shrubs.

Capability subclass IIIw; woodland ordination 4W.

GrC—Gresham silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and somewhat poorly drained. It is on undulating and rolling uplands in the northwest part of the county. Slopes are smooth, concave, and convex. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is mottled and extends to a depth of at least 75 inches. The upper 13 inches of the subsoil is yellowish brown, strong brown, and grayish brown, friable silt loam. The next 18 inches is brown, firm and brittle silt loam. The lower 36 inches is strong brown and yellowish brown, firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of moderately sloping and moderately steep Gresham soils and soils similar to this Gresham soil but that have more rock fragments throughout the upper part. Also included are small areas of Titusville, Riverhead, Wheeling, Fredon, Braceville, and Frenchtown soils.

The permeability of this Gresham soil is moderate and moderately slow above the firm part of the subsoil and slow in the firm part. The seasonal high water table is at a depth of 6 to 18 inches. Runoff is medium to rapid. The available water capacity is moderate. In unlimed areas this soil is extremely acid to strongly acid to a depth of 40 inches, strongly acid or moderately acid between depths of 40 and 60 inches, and neutral or mildly alkaline at a depth of more than 60 inches. Rooting depth is restricted by the firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage where outlets are available helps to improve drainage and allows timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and maintain tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. The restricted rooting depth is a main limitation for trees. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment during wet periods, but machine planting is usually practical during dry periods.

Slope, the slow permeability, and the seasonal high water table limit this soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. The soil is suitable as a site for wildlife habitat, some types of recreation areas, and grasses and shrubs.

Capability subclass: IIIe; woodland ordination: 4W.

HaB—Hazleton channery loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and well drained. It is on broad and narrow ridgetops throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 100 acres.

Typically, the surface layer is dark grayish brown channery loam about 7 inches thick. The subsoil is 27 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 15 inches is strong brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 84 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of 84 inches.

Included with this soil in mapping are small areas of nearly level and strongly sloping Hazleton soils and soils similar to this Hazleton soil but that contain more sand in the surface layer and in the upper part of the subsoil, contain more silt above the substratum, or have bedrock at a depth of less than 40 inches. Also included are small areas of Gilpin, Clymer, Weikert, Cookport, Tilsit, Buchanan, Andover, and Wharton soils.

The permeability of this Hazleton soil is rapid or moderately rapid. Runoff is medium, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout.

Most areas of this soil are used for crops and pasture.

This soil is well suited to corn, vegetables, fruit, small grains, and grasses and legumes. Conservation tillage, cover crops and grasses and legumes in cropping system, and stripcropping on long slopes will help to reduce runoff and control a moderate hazard of erosion. Diversions and grassed waterways help to reduce runoff and control erosion on long slopes. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a management practice. Machine planting on larger areas is practical.

This soil has few limitations for most urban uses. In some areas the depth to bedrock is a limitation for onsite waste disposal and for construction of buildings with basements. The rapid or moderately rapid permeability and seepage are limitations if this soil is used as a site for sanitary landfills. Rock fragments on the surface limit this soil as a site for lawns, landscaping, playgrounds, and athletic fields.

Capability subclass: IIe; woodland ordination: 4F.

HaC—Hazleton channery loam, 8 to 15 percent slopes. This soil is strongly sloping, deep, and well drained. It is on undulating and rolling uplands throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 10 acres.

Typically, the surface layer is dark grayish brown channery loam about 7 inches thick. The subsoil is 27 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 15 inches is strong brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 84 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of 84 inches.

Included with this soil in mapping are small areas of gently sloping and moderately steep Hazleton soils and soils similar to this Hazleton soil but that contain more sand in the surface layer and in the upper part of the subsoil, contain more silt above the substratum, or have bedrock at a depth of less than 40 inches. Also included are a few areas of Gilpin, Weikert, Clymer, Cookport, Buchanan, Ernest, Wharton, and Cavode soils.

The permeability of this Hazleton soil is rapid or moderately rapid. Runoff is medium or rapid, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout.

Most areas of this soil are used for crops and pasture. Some areas are in orchards and woodland.

This soil is fairly well suited to corn, vegetables, and small grains. It is well suited to fruit and grasses and legumes. Conservation tillage, cover crops and grasses and legumes in the cropping system, contour stripcropping, and grassed waterways will help to reduce runoff and control a severe hazard of erosion. Diversions on long slopes also will help to reduce runoff and control erosion. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a management practice. Machine planting on large areas is practical.

Slope and, in some areas, depth to bedrock limit this soil as a site for waste disposal and buildings. The rapid or moderately rapid permeability and seepage are limitations if this soil is used as a site for sanitary landfill. Rock fragments on the surface and slope limit the soil as a site for lawns, landscaping, playgrounds, and athletic fields.

Capability subclass: IIIe; woodland ordination: 4F.

HaD—Hazleton channery loam, 15 to 25 percent slopes. This soil is moderately steep, deep, and well drained. It is on hills and side slopes on uplands throughout the county. Slopes are mainly convex. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres.

Typically, the surface layer is dark grayish brown channery loam about 7 inches thick. The subsoil is 27 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 15 inches is strong brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 72 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of 72 inches.

Included with this soil in mapping are small areas of sloping and steep Hazleton soils and soils similar to this Hazleton soil but that contain more sand and rock fragments in the surface layer and upper part of the subsoil or have bedrock at a depth of less than 40 inches. Also included are a few areas of Gilpin, Weikert, Cookport, Buchanan, Ernest, Wharton, Cavode, and Andover soils.

The permeability of this Hazleton soil is rapid or moderately rapid. Runoff is rapid, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout.

Most areas of this soil are used for crops, pasture, or woodland or are in native vegetation.

This soil is poorly suited to corn, vegetables, and small grains. It is fairly well suited to orchards and well suited to drought-resistant grasses and legumes. If this soil is used for cropland, a crop rotation dominated by grasses and legumes, conservation tillage, contour stripcropping, cover crops, mixing crop residue into the surface layer, and grassed waterways help to reduce runoff and control a very severe hazard of erosion.

This soil is fairly well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Periodic applications of nutrients help to maintain fertility.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Slope limits the use of equipment, but machine planting generally is practical on the larger areas.

Slope and, in places, depth to the bedrock limit this soil as a site for waste disposal, buildings, and streets and roads. This soil is suitable as a site for some recreation areas, wildlife habitat, and grasses and shrubs.

Capability subclass: IVe; woodland ordination: 4F.

HaE—Hazleton channery loam, 25 to 35 percent slopes. This soil is steep, deep, and well drained. It is on hillsides and side slopes on uplands throughout the county. Slopes are mainly convex. The areas are long and narrow and range from 1 acre to 25 acres.

Typically, the surface layer is dark grayish brown channery loam about 7 inches thick. The subsoil is 27 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 15 inches is strong brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 60 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are small areas of moderately steep, very steep, and stony Hazleton soils and soils similar to this Hazleton soil but that contain more sand and rock fragments in the surface layer and upper part of the subsoil or have bedrock at a depth of less than 40 inches. Also included are a few areas of Gilpin, Weikert, Cookport, Buchanan, and Ernest soils.

The permeability of this Hazleton soil is rapid or moderately rapid. Runoff is rapid, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout.

Most areas of this soil are used for woodland and pasture, or they are idle.

Slope, rapid runoff, and a very severe hazard of erosion make this soil generally unsuited to crops and poorly suited to pasture. If the soil is used for pasture, overgrazing is a major management concern. Proper stocking rates, rotation grazing, and maintaining fertility through periodic applications of nutrients will help keep the pasture and soil in condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice that helps to conserve moisture. Slope limits the use of equipment for planting, maintaining, and harvesting trees.

Slope is the major limitation of this soil for urban uses. The soil is suitable for wildlife habitat, some recreation areas, and grasses and shrubs.

Capability subclass: VIe; woodland ordination: 4F.

HbB—Hazleton loam, 0 to 8 percent slopes, very stony. This soil is nearly level and gently sloping, deep, and well drained. It is on ridgetops throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres. Stones that are 1 to 3 feet in diameter cover about 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown channery loam about 2 inches thick. The subsurface layer is brown channery loam about 5 inches thick. The subsoil is 27 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 15 inches is strong brown and brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 84

inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of about 84 inches.

Included with this soil in mapping are areas of strongly sloping to moderately steep Hazleton soils and soils similar to this Hazleton soil but that contain more sand in the surface layer and upper part of the subsoil, contain more silt above the substratum, or have bedrock at a depth of less than 40 inches. In a few small areas of this unit, less than 3 percent of the surface is covered with stones. Also included are small areas of Gilpin, Clymer, Weikert, Cookport, Wharton, Buchanan, Ernest, and Andover soils.

The permeability of this Hazleton soil is rapid or moderately rapid. Runoff is slow to medium, and the available water capacity is moderate. This soil is strongly acid to extremely acid throughout.

The stones on the surface make this soil poorly suited to crops and pasture. The soil is suited to trees, and most areas are wooded. Potential productivity is moderately high. Removing undesirable species is a main management practice. The stones on the surface limit the use of equipment for planting, maintaining, and harvesting trees.

The stones on the surface and, in places, the depth to bedrock limit this soil as a site for waste disposal and buildings.

Capability subclass: VIs; woodland ordination: 4F.

HgD—Hazleton and Gilpin soils, 8 to 25 percent slopes, very stony. This unit is made up of deep Hazleton soils and moderately deep Gilpin soils on strongly sloping and moderately steep ridgetops and side slopes throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 200 acres. Some areas consist mostly of well drained Hazleton soils, some mostly of well drained Gilpin soils, and some of both. Where these two soils are in the same area, the Hazleton soils generally make up the higher percentage. Stones that range mainly from 1 foot to 10 feet in diameter cover about 3 to 15 percent of the surface.

The Hazleton soils make up about 55 percent of the total acreage of this unit. Typically, they have a surface layer of very dark grayish brown channery loam about 1 inch thick. The subsurface layer is brown channery loam about 5 inches thick. The subsoil is 28 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 16 inches is strong brown and brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 72 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of about 72 inches.

The Gilpin soils make up about 30 percent of the total acreage of this unit. Typically, they have a surface layer of very dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is yellowish brown or brown channery silt loam about 5 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 14 inches thick. Fractured siltstone bedrock is at a depth of 36 inches.

Included with these soils in mapping are areas of gently sloping and steep Hazleton and Gilpin soils and soils similar to the Hazleton soils but that contain more sand in the surface layer and subsoil or have bedrock at a depth of less than 40 inches. In some areas of this unit stones cover less than 3 percent of the surface or 15 to 50 percent of the surface. A few areas of soils are similar to the Gilpin soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Weikert, Clymer, Ernest, Buchanan, Wharton, Cookport, and Cavode soils.

Permeability is moderate in the Gilpin soils and rapid and moderately rapid in the Hazleton soils. Runoff is medium to rapid on both soils, and the available water capacity is moderate. These soils are strongly acid to extremely acid throughout. The depth to bedrock ranges from 20 to 40 inches in the Gilpin soils and is at least 40 inches in the Hazleton soils.

Slope and the stones on the surface make these soils poorly suited to crops and pasture. The soils are suited to trees, and most areas are wooded. Potential productivity is moderately high. Rooting depth is restricted in the Gilpin soils by bedrock at a depth of 20 to 40 inches. Removing undesirable species is a main management practice. Slope limits the use of equipment for planting, maintaining, and harvesting trees.

The stones on the surface and the slope are major limitations of the soils for urban uses.

Capability subclass: VIs; woodland ordination: 4F for the Hazleton part and 4R for the Gilpin part.

HgF—Hazleton and Gilpin soils, 25 to 70 percent slopes, very stony. This unit is made up of deep Hazleton soils and moderately deep Gilpin soils on hillsides and side slopes on uplands throughout the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 2 to 200 acres. Some areas consist mostly of well drained Hazleton soils, some mostly of well drained Gilpin soils, and some of both. Where these soils are in the same area, the Hazleton soils generally make up the higher percentage. Stones that range mainly from 1 foot to 10 feet in diameter cover about 3 to 15 percent of the surface.

The Hazleton soils make up about 60 percent of the total acreage of this unit. Typically, they have a surface layer of very dark grayish brown channery loam about 1

inch thick. The subsurface layer is brown channery loam about 5 inches thick. The subsoil is 28 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown channery loam. The lower 16 inches is strong brown and brown channery loam, channery sandy loam, and very channery sandy loam. The substratum extends to a depth of 60 inches. It is strong brown and yellowish brown, firm to friable very channery loamy sand and very channery sandy loam. Fractured sandstone bedrock is at a depth of about 60 inches.

The Gilpin soils make up about 25 percent of the total acreage of this unit. Typically, they have a surface layer of very dark grayish brown channery silt loam about 1 inch thick. The subsurface layer is yellowish brown or brown channery silt loam about 5 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 14 inches thick. Fractured siltstone bedrock is at a depth of 36 inches.

Included with these soils in mapping are areas of sloping and moderately steep Hazleton and Gilpin soils. Also included are escarpments, bedrock outcrops, and soils similar to the Hazleton soils but that contain more sand and rock fragments in the upper part or have bedrock at a depth of less than 40 inches. In some areas of this unit stones cover less than 3 percent of the surface or 15 to 50 percent of the surface. A few areas of Weikert, Cookport, Ernest, and Buchanan soils are also included.

Permeability is moderate in the Gilpin soils and rapid and moderately rapid in the Hazleton soils. Runoff is rapid on both soils, and the available water capacity is moderate. These soils are strongly acid to extremely acid throughout. The depth to bedrock ranges from 20 to 40 inches in the Gilpin soils and is at least 40 inches in the Hazleton soils.

Slope and the stones on the surface make these soils unsuited to crops and pasture. The soils are suited to trees, and most areas are wooded. Potential productivity is moderate for the Hazleton soils and moderately high for the Gilpin soils. Rooting depth is restricted in the Gilpin soils by bedrock at a depth of 20 to 40 inches. Removing undesirable species is a main management concern. Slope limits the use of equipment for planting, maintaining, and harvesting trees.

The stones on the surface and the slope are major limitations of the soils for urban uses.

Capability subclass: VIIs; woodland ordination: 3R for the Hazleton and 4R for the Gilpin part.

MoB—Monongahela silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and moderately well drained. It is on terraced lowlands and benches dominantly in the valleys of the Connoquenessing and Brush Creeks. Slopes are smooth or concave. The areas are irregular in shape and range from 2 to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 31 inches thick. The upper 11 inches of the subsoil is yellowish brown, firm silt loam. The lower 20 inches is brown, mottled, very firm and brittle gravelly silt loam and gravelly sandy clay loam. The substratum is brown, mottled, firm gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of nearly level and sloping Monongahela soils and areas of Wheeling, Caneadea, Wharton, Cavode, Ernest, and Brinkerton soils.

The permeability of this Monongehela soil is moderate above the lower part of the subsoil, moderately slow or slow in the lower part of the subsoil, and moderately slow in the substratum. This soil has a seasonal high water table at a depth of 18 to 36 inches for long periods during wet seasons. Runoff is slow or medium. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the lower part of the subsoil.

This soil is used mainly for crops. In the vicinity of Zelienople, the soil is in urban uses, including parks, lawns, and vacant lots.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage helps to improve drainage and allows timely tillage. Conservation tillage, stripcropping cover crops, grasses and legumes in the cropping system, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Machine planting is practical on the larger areas.

The permeability in the lower part of the subsoil and the seasonal high water table limit this soil as a site for many urban uses, especially waste disposal, buildings, and streets and roads. If this soil is disturbed for construction, management practices will be needed to reduce runoff and sedimentation.

Capability subclass: IIe; woodland ordination: 4A.

MoC—Monongahela silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and

moderately well drained. It is on terraced slopes and benches dominantly in the valleys of the Connonquenessing and Brush Creeks. Slopes are concave or convex. The areas are long and narrow and range from 2 to 25 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 31 inches thick. The upper 11 inches of the subsoil is yellowish brown, firm silt loam. The lower 20 inches is brown, mottled, very firm and brittle gravelly silt loam and gravelly sandy clay loam. The substratum is brown, mottled, firm gravelly sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping and moderately steep Monongahela soils and narrow escarpments. Also included are areas of Wheeling, Riverhead, Wharton, Cavode, and Ernest soils.

The permeability of this Monongehela soil is moderate above the lower part of the subsoil, moderately slow or slow in the lower part of the subsoil, and moderately slow in the substratum. This soil has a seasonal high water table at a depth of 18 to 36 inches for long periods during wet seasons. Runoff is medium to rapid. The available water capacity is moderate. In unlimed areas this soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the lower part of the subsoil.

Most areas of this soil are used for crops or pasture.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species is a main management practice. Machine planting is practical on the larger areas.

The slope, the permeability in the lower part of the subsoil, and the seasonal high water table limit this soil as a site for many urban uses, especially waste disposal, buildings, and streets and roads. If this soil is disturbed for construction, management practices will be needed to reduce runoff and sedimentation.

Capability subclass: IIIe; woodland ordination: 4A.

Ph—Philo loam. This soil is nearly level, deep, and moderately well drained. It is on flood plains throughout the county. The areas are long and narrow and range from 2 to 40 acres. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is dark yellowish brown sandy loam about 26 inches thick. It is mottled in the lower 16 inches. The substratum extends to a depth of 60 inches or more. It is grayish brown, mottled sandy loam underlain by yellowish brown, stratified gravelly sand, loamy sand, and sandy loam.

Included with this soil in mapping are small areas of Philo soils with a surface layer of silt loam or sandy loam or that are rarely flooded and soils similar to this Philo soil but that are mottled at a depth of 24 to 30 inches. Also included are small areas of Atkins and Pope soils.

The permeability of this Philo soil is moderate in the subsoil and upper part of the substratum and moderately rapid in the lower part of the substratum. The available water capacity is moderate to high. Runoff is slow. Flooding is frequent, and the seasonal high water table is at a depth of 18 to 36 inches. In unlimed areas this soil is very strongly acid to moderately acid throughout.

Most areas of this soil are used for crops and pasture, but some areas are in woodland or native vegetation.

This soil is well suited to corn, soybeans, vegetables, and grasses and legumes. Flooding, wetness, and frost heaving damage some fall-sown grains and alfalfa during winter. Flooding sometimes occurs during the growing season. The use of surface and subsurface drainage where outlets are available helps to improve drainage and allow timely tillage. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition. Keeping natural drainageways open will improve drainage.

This soil is suited to trees. Potential productivity is moderately high. The rooting depth is restricted in some areas by the seasonal high water table, and the water table limits the use of equipment for brief periods. Machine planting on large areas is usually practical.

The seasonal high water table and the flooding limit this soil for urban uses. The soil is suitable for wildlife habitat, some recreation areas, and grasses and shrubs.

Capability subclass: IIw; woodland ordination: 5W.

Pn—Pits, sand and gravel. This unit is dominantly in the northwest part of the county. It consists of land that has been excavated primarily to obtain sand, gravel, or weathered sandstone for fills, subgrades, concrete, and other uses. Most areas consist of a pit and an escarpment surrounded by piles of material removed from the surface, rock fragments, sand and gravel, or other material. The original soils have been covered or

destroyed by digging or by mixing them with material from other soils, sand and gravel, or stones.

Included with this unit in mapping are small areas of Riverhead, Wheeling, Titusville, Braceville, and Hazleton soils. Also included are a few small areas that have been quarried for sandstone, shale, or limestone. Included areas make up about 10 percent of this unit.

The permeability in this unit ranges from moderately rapid to very rapid, available water capacity is low or very low, and runoff ranges from medium to very rapid. The material ranges from neutral to very strongly acid. Bedrock is between the surface and a depth of at least 60 inches.

Most of this unit is barren or has sparse stands of grasses, shrubs, and trees. The unit is generally too steep, too droughty, too gravelly, or too sandy to support vegetation. Onsite investigation is needed to determine the potential and limitations of this unit for any use.

Capability subclass and woodland ordination: not assigned.

Po—Pope loam. This soil is nearly level, very deep, and well drained. It is on flood plains along the major waterways in the county. The areas are long and narrow and range from 2 to 30 acres. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is 38 inches thick. The upper 33 inches of the subsoil is brown fine sandy loam. The lower 5 inches is yellowish brown loam or fine sandy loam. The substratum extends to a depth of 60 inches or more. It is yellowish brown sandy loam underlain by brown stratified very gravelly loamy sand and loamy sand.

Included with this soil in mapping are small areas of Pope soils with a surface layer of silt loam or sandy loam or that are rarely or never flooded and soils similar to this Pope soil but that have a subsoil of loamy sand. Also included are small areas of Atkins and Philo soils.

The permeability of this Pope soil is moderately rapid or moderate, and the available water capacity is moderate to high. In unlimed areas this soil is strongly acid to extremely acid. Runoff is slow, and the soil is occasionally flooded.

Most areas of this soil are used for crops. Some small areas with limited access are in pasture, woodland, or native vegetation.

This soil is well suited to corn, soybeans, small grains, vegetables, and grasses and legumes. Flooding sometimes occurs during the growing season, and flooding damages some fall-sown grains. Mixing crop residue into the surface layer will help maintain the organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing will help keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Machine planting is practical on large areas.

Flooding limits this soil as a site for buildings and waste disposal. In urban areas the soil is well suited to wildlife habitat, some recreation areas, and grasses and shrubs.

Capability class: I; woodland ordination: 5A.

RdB—Riverhead sandy loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and well drained. It is on outwash plains, kames, and terraces dominantly in the northwest part of the county. Slopes are smooth or convex. The areas are irregular in shape and range from 2 to 50 acres.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is brown sandy loam about 17 inches thick. The substratum extends to a depth of 60 inches or more. It is brown and pale brown stratified gravelly loamy sand and loamy sand.

Included with this soil in mapping are a few small areas of nearly level and sloping Riverhead soils and soils similar to this Riverhead soil but that contain more gravel and cobblestones in the surface layer and subsoil or contain more silt or clay in the subsoil. Also included are small areas of Wheeling, Braceville, Titusville, and Fredon soils.

The permeability of this Riverhead soil is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is moderate. Runoff is medium. In unlimed areas this soil is very strongly acid or strongly acid in the surface layer and subsoil, and ranges from very strongly acid to neutral at a depth of more than 30 inches.

Most areas of this soil are used for crops or pasture.

This soil is generally well suited to corn, vegetables, fruit, small grains, and grasses and legumes. Crops respond well to fertilizer, but some are damaged during periods of low rainfall. Stripcropping, grassed waterways, conservation tillage, and cover crops and grasses and legumes in the cropping system will reduce runoff and control erosion. Mixing crop residue into the surface layer will help to maintain organic matter content and improve tilth.

This soil is well suited to pasture plants, especially to drought-resistant grasses and legumes. Proper stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

This soil is suited to trees. Potential productivity is moderate. Removing undesirable species is a main management practice. Machine planting on large areas is practical.

This soil has few limitations for most urban uses. The permeability in the substratum causes a hazard of ground-water contamination in areas used for waste disposal or sanitary landfills.

Capability subclass: IIs; woodland ordination: 3A.

RdC—Riverhead sandy loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and well drained. It is on outwash plains, kames, eskers, and terraces dominantly in the northwest part of the county. Slopes are convex. The areas are long and narrow and range from 2 to 30 acres.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is brown sandy loam about 17 inches thick. The substratum extends to a depth of 60 inches or more. It is brown and pale brown stratified gravelly loamy sand and loamy sand.

Included with this soil in mapping are small areas of gently sloping, moderately steep, and steep Riverhead soils and soils similar to this Riverhead soil but that contain more gravel and cobblestones in the surface layer and subsoil. Also included are small areas of Hazleton, Wheeling, Titusville, Braceville, and Fredon soils.

The permeability of this Riverhead soil is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is moderate. Runoff is medium or rapid. In unlimed areas this soil is very strongly acid or strongly acid in the surface layer and subsoil, and ranges from very strongly acid to neutral at a depth of more than 30 inches.

Most areas of this soil are used for crops, pasture, or woodland.

This soil is fairly well suited to corn, small grains, and fruit. It is well suited to drought-resistant grasses and legumes. Crops respond well to fertilizer, but some are damaged during periods of low rainfall. Contour stripcropping, grassed waterways, conservation tillage, mixing crop residue into the surface layer, and cover crops and grasses and legumes in the cropping system will reduce runoff, control erosion, and improve tilth.

This soil is well suited to pasture plants, especially to drought-resistant grasses and legumes. Proper stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

This soil is suited to trees. Potential productivity is moderate. Removing undesirable species is a main management practice. Machine planting on large areas is practical.

Slope limits this soil for some urban uses, and the permeability in the substratum causes a hazard of ground-water contamination in areas used for the waste disposal or sanitary landfills.

Capability subclass: IIIe; woodland ordination: 3A.

TaA—Tilsit silt loam, 0 to 3 percent slopes. This soil is nearly level, deep, and moderately well drained. It is on broad ridgetops dominantly in the southern half of the county. Slopes are smooth or concave. The areas are irregular in shape and range from 2 to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is yellowish brown and dark yellowish brown silt loam about 3 inches thick. The subsoil is 44 inches thick. The upper 14 inches of the subsoil is yellowish brown, friable or slightly firm silt loam that is mottled in the lower part. The lower 30 inches is yellowish brown, mottled, very firm and brittle silt loam. The substratum is dark yellowish brown, mottled, firm very channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of gently sloping Tilsit soils and soils similar to this Tilsit soil but that are mottled with gray in the upper part of the subsoil or are underlain by bedrock at a depth of less than 40 inches. Also included are areas of Wharton, Gilpin, Ernest, Cookport, and Brinkerton soils.

The permeability of this Tilsit soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is slow, and ponding occurs in some depressions during wet seasons. The available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout. Rooting depth is restricted by the lower part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Wetness and frost heaving damage winter grains and alfalfa, and the ponding is common in low areas in spring and after heavy rainfall. Subsurface drains will help to alleviate wetness. Mixing crop residue into the surface layer helps to maintain organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for brief periods, but machine planting is practical on the larger areas.

The permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. Foundation drains help to prevent seepage into basements in this soil.

Capability subclass: IIw; woodland ordination: 4A.

TaB—Tilsit silt loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and moderately well drained. It is on broad ridgetops dominantly in the southern half of the county. Slopes are smooth, concave, or convex. The areas are irregular in shape and range from 2 to 150 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is yellowish brown and dark yellowish brown silt loam about 3 inches thick. The subsoil is 44 inches thick. The upper 14 inches of the subsoil is yellowish brown, friable or slightly firm silt loam that is mottled in the lower part. The lower 30 inches is yellowish brown, mottled, very firm and brittle silt loam. The substratum is dark yellowish brown, mottled, firm very channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of nearly level and sloping Tilsit soils and soils similar to this Tilsit soil but that contain more rock fragments in the subsoil or are underlain by bedrock at a depth of less than 40 inches. Also included are areas of Gilpin, Wharton, Weikert, Cavode, Cookport, Ernest, and Brinkerton soils.

The permeability of this Tilsit soil is moderate above the lower part of the subsoil, slow in the lower part of the subsoil, and moderately slow or slow in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. Runoff is medium. The available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid throughout. Rooting depth is restricted by the lower part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. Subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for brief periods, but machine planting is practical on the larger areas.

The permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. Foundation drains help to prevent seepage into basements in this soil.

Capability subclass: IIe; woodland ordination: 4A.

TeB—Titusville silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and moderately well drained. It is on smooth and undulating till plains and moraines in the northwest part of the county. Slopes are smooth, convex, or concave. The areas are irregular in shape and range from 1 acre to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper 14 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 13 inches is yellowish brown, mottled, firm and brittle silt loam. The lower 24 inches is strong brown and brown, mottled, firm and brittle loam and clay loam.

Included with this soil in mapping are small areas of nearly level and strongly sloping Titusville soils and soils similar to this Titusville soils but that have more rock fragments throughout the upper part or have mottles and a firm layer only at a depth of more than 30 inches. Also included are a few areas of Gresham, Frenchtown, Wheeling, and Braceville soils.

The permeability of this Titusville soil is moderately slow above the firm part of the subsoil and slow in the firm part of the subsoil. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is slow to medium, and the available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid to a depth of 40 inches and strongly acid to neutral below a depth of 40 inches. Rooting depth is restricted by the firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is suitable for corn, vegetables, small grains, and grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. Subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for brief periods but machine planting is practical on the larger areas.

The permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. Foundation drains help to prevent seepage into basements in this soil.

Capability subclass: IIe; woodland ordination: 4D.

TeC—Titusville silt loam, 8 to 15 percent slopes. This soil is strongly sloping, very deep, and moderately well drained. It is on undulating to rolling uplands and

moraines in the northwest part of the county. Slopes are smooth, concave, or convex. The areas are irregular in shape or long and narrow and range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper 14 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 13 inches is yellowish brown, mottled, firm and brittle silt loam. The lower 24 inches is strong brown and brown, mottled, firm and brittle loam and clay loam.

Included with this soil in mapping are small areas of gently sloping and moderately steep Titusville soils, soils similar to this Titusville soil but that have more rock fragments throughout the upper part or have mottles and a firm layer only at a depth of more than 30 inches. Also included are a few areas of Gresham, Frenchtown, Wheeling, and Braceville soils.

The permeability of this Titusville soil is moderately slow above the firm part of the subsoil and slow in the firm part of the subsoil. The seasonal high water table is at a depth of 18 to 36 inches. Runoff is medium to rapid. The available water capacity is moderate. In unlimed areas this soil is strongly acid to extremely acid to a depth of 40 inches and strongly acid to neutral below a depth of 40 inches. Rooting depth is restricted by the firm part of the subsoil.

Most areas of this soil are used for crops and pasture.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, contour stripcropping, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is fairly well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. The restricted rooting depth is a main management concern. Removing undesirable species is a main management practice. The seasonal high water table limits the use of equipment for brief periods during wet seasons, but machine planting is practical on the larger areas.

The seasonal high water table, the slow permeability, and the slope are major limitations of this soil as a site waste disposal and buildings with basements. If buildings are constructed on this soil, foundation drains with proper outlets will help to prevent seepage of water into the basements. If this soil is disturbed for construction, management practices will be needed to prevent seepage and control erosion and sedimentation.

Capability subclass: IIIe; woodland ordination: 4D.

TrD—Titusville and Riverhead soils, 15 to 30 percent slopes. This unit is made up of moderately steep and steep, very deep Titusville and Riverhead soils on side slopes and hills on uplands in the northwest part of the county. Slopes are smooth or convex. The areas are long and narrow and range from 1 acre to 25 acres. Some areas consists mostly of moderately well drained Titusville soils, some mostly of well drained Riverhead soils, and some of both. Where these two soils are in the same area, the Titusville soils generally make up the higher percentage.

The Titusville soils make up about 40 percent of the total acreage of this unit. Typically, they have a surface layer of dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches of more. The upper 14 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 13 inches is yellowish brown, mottled, firm and brittle silt loam. The lower 24 inches is strong brown and brown, mottled, firm and brittle loam and clay loam.

The Riverhead soils make up about 35 percent of the total acres of this unit. Typically, they have a surface layer of dark brown sandy loam about 10 inches thick. The subsoil is brown sandy loam about 17 inches thick. The substratum extends to a depth of 60 inches or more. It is brown or pale brown stratified loamy sand and gravelly loamy sand.

Included with these soils in mapping are small areas of sloping and very steep Titusville and Riverhead soils and a few areas of Hazleton, Gilpin, Wharton, Cavode, and Gresham soils. Also included are soils similar to the Titusville soils but that have more rock fragments throughout or have a firm layer and mottles only at a depth of more than 30 inches. Some small areas consist of soils similar to the Riverhead soils but contain more gravel at a depth of less than 40 inches.

The permeability in the Titusville soils is moderately slow above the firm part of the subsoil and slow in the firm part of the subsoil. The seasonal high water table is at a depth of 18 to 36 inches, and the available water capacity is moderate. The permeability in the Riverhead soils is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is moderate. In unlimed areas the Titusville soils are strongly acid to extremely acid to a depth of 40 inches and strongly acid to neutral below a depth of 40 inches; the Riverhead soils are very strongly acid or strongly acid in the surface layer and subsoil and range from very strongly acid to neutral in the substratum. On both soils runoff is rapid or very rapid and the hazard of erosion is very severe. Rooting depth is restricted in the Titusville soils by the firm part of the subsoil.

Most areas of these soils are used for crops, pasture, and woodland or are in native vegetation.

Slope and the hazard of erosion make these soils poorly suited to corn and small grains. The soils are fairly well suited to drought-resistant grasses and legumes. If these soils are used for cropland, a crop rotation dominated by grasses and legumes, conservation tillage, cover crops, contour stripcropping, mixing crop residues into the surface layer, and grassed waterways will reduce runoff and control erosion.

These soils are fairly well suited to poorly suited pasture. Shallow-rooting, drought-resistant grasses and legumes are the more suitable types. Overgrazing and grazing, when the soil is wet are the major pasture management concerns. Proper stocking rates, rotation grazing and restricting grazing during wet or very dry periods will help to keep the pasture and soils in good condition.

These soils are suited to trees. Potential productivity is moderate for the Riverhead soils and moderately high for the Titusville soils. Removing undesirable species is a main management practice. Slope limits the equipment for planting, maintaining, and harvesting trees.

The main limitations of this unit for most urban uses are slope, the seasonal high water table and slow permeability in the Titusville soils, and the very rapid permeability in the Riverhead soils. They limit the unit as a site for waste disposal, buildings, and roads and streets.

Capability subclass: VIe; woodland ordination: 4R for the Titusville part and 3R for the Riverhead part.

UaB—Udorthents, acid material, gently sloping. This unit consists dominantly of very channery or extremely channery, loamy soil material on ridgetops, side slopes, benches, and lowlands. The material is in areas that have been strip-mined for coal. The areas are throughout the county, but most are in the northern half. The areas are irregular in shape or long and narrow and range from 1 acre to 30 acres. Slopes are mainly smooth or hummocky, and they range from 0 to 8 percent.

The thickness of the fill material in this unit ranges from several feet to more than 100 feet. The source of the material is mainly Gilpin, Hazleton, Buchanan, Ernest, Wharton, and Cavode soils. The diameter of the rock fragments ranges from less than half an inch to 10 inches or more. They make up 30 to 95 percent of the material. They consist of shale, siltstone, and sandstone and small quantities of coal, carbonaceous shale, and some limestone. Small amounts of organic material, mainly roots and other parts of trees, and nonorganic material, such as glass and steel, are in a few areas.

Included with these soils in mapping are small areas of strongly sloping to very steep Udorthents and Fluvaquents, Arents, and bedrock escarpments. Small areas of Gilpin, Weikert, Hazleton, Buchanan, Ernest, Wharton, and Cavode soils are also included.

The permeability in these Udorthents ranges from slow to rapid. The available water capacity ranges from moderate to very low. Runoff ranges from rapid to very slow. Ponding of runoff or ground water occurs in low areas and depressions. Flooding occurs in some areas. The hazard of erosion is slight to severe. The soils range from extremely acid to strongly acid.

Many areas of these soils are barren or have sparse stands of grasses, briars, aspen, and red maple. Trees, primarily conifers, have been planted in some areas (fig. 10). Some areas have been backfilled, smoothed, and seeded with grasses and legumes. A few areas are used for cropland.

These soils generally contain too many rock fragments to be used for crops. If some areas that are not too channery or too stony are smoothed and if intensive management practices are used, the soils can be used for crops and are fairly well suited to drought-resistant grasses and legumes. Lime and fertilizer and, in some areas, irrigation are needed. Conservation tillage, cover crops and grasses and legumes in the cropping system, stripcropping, and mixing crop residue into the surface layer will reduce runoff and control erosion.

If reclaimed areas are used for pasture, the main needs are lime and fertilizer, proper stocking rates, and rotation grazing.

Most areas of these soils are suitable for trees. Lime and fertilizer generally are needed. Removing undesirable species will conserve moisture and improve production. Machine planting on the larger, less channery or stony areas is generally practical.

The variability of the characteristics of this unit make onsite investigation necessary to determine the potentials and limitations of the unit for any use. Some areas are suitable for wildlife habitat, some types of recreation, and grasses and shrubs.

Capability subclass and woodland ordination: not assigned.

UaD—Udorthents, acid material, moderately steep. This unit consists dominantly of very channery or extremely channery, loamy soil material on ridgetops, side slopes, benches, and lowlands. The material is in areas that have been strip-mined for coal. The areas are throughout the county but are dominantly in the northern half. They are irregular in shape or long and narrow and range from 2 to 100 acres. Slopes are complex and irregular or smooth, and they range from 8 to 25 percent.

The thickness of the fill material in this unit ranges from several feet to more than 100 feet. The source of the material is mainly Gilpin, Hazleton, Buchanan, Ernest, Wharton, and Cavode soils. The diameter of the rock fragments ranges from less than half an inch to 10 inches or more. They make up 30 to 95 percent of the material. They consist of shale, siltstone, and sandstone

Figure 10.—Conifers and sparse stands of grass on Udorthents, acid material, gently sloping.

and small quantities of coal, carbonaceous shale, and some limestone. Small amounts of organic material, mainly roots and other parts of trees, and nonorganic material, such as glass and steel, are in a few areas.

Included with these soils in mapping are small areas of nearly level, gently sloping, steep, and very steep Udorthents and Arents and bedrock escarpments. Small areas of Gilpin, Weikert, Hazleton, Ernest, Buchanan, Wharton, and Cavode soils are also included. Ponding of runoff and ground water occurs in some depressions.

The permeability in these Udorthents ranges from moderately slow to rapid. The available water capacity is dominantly low or very low. Runoff ranges from medium to very rapid. These soils range mainly from extremely acid to strongly acid. The hazard of erosion is moderate to very severe.

Many areas of these soils are barren or have sparse stands of grasses, briars, aspen, and red maple. Trees, primarily conifers, have been planted on some areas. Some areas have been regraded, smoothed, and seeded with grasses and legumes. A few small areas are used for crops.

These soils generally contain too many rock fragments and are too sloping to be used for crops. If some areas that are not too channery or too stony are smoothed and if intensive management practices are used, the soils can be used for crops and are fairly well suited to drought-resistant grasses and legumes. Lime and fertilizer and, in some areas, irrigation are needed. Conservation tillage, cover crops and grasses and legumes in the cropping system, stripcropping, and mixing crop residue into the surface layer will reduce runoff and control erosion.

If reclaimed areas are used for pasture, the main needs are lime and fertilizer, proper stocking rates, and rotation grazing.

Most areas of these soils are suitable for trees, but areas with complex slopes should be smoothed and lime and fertilizer are usually needed. Removing undesirable plants will conserve moisture and improve production. Machine planting on the larger, smoother areas that are not too channery or stony is generally practical.

The variability of the characteristics of this unit make onsite investigation necessary to determine the potentials and limitations of the unit for any use. Some areas are suitable for wildlife habitat, some types of recreation, and grasses and shrubs.

Capability subclass and woodland ordination: not assigned.

UaF—Udorthents, acid material, very steep. This unit consists of very channery or extremely channery, loamy soil material on ridgetops, hillsides, benches, and lowlands. The material is in areas that have been strip-mined for coal. The areas are throughout the county, but most are in the northern half. The areas are irregular in shape or long and narrow and range from 2 to 100 acres. Slopes are complex and irregular or smooth and range from 25 to 100 percent.

The thickness of the fill material in this unit ranges from several feet to more than 100 feet. The source of the material is mainly Gilpin, Hazleton, Buchanan, Ernest, Wharton, and Cavode soils. The diameter of the rock fragments ranges from less than half an inch to 10 inches or more. They make up 30 to 95 percent of the material. They consist of shale, siltstone, and sandstone and small quantities of coal, carbonaceous shale, and some limestone. Small amounts of organic material, mainly roots and other parts of trees, and nonorganic material, such as glass and steel, are in a few areas.

Included with these soils in mapping are small areas of gently sloping, sloping, and moderately steep Udorthents and Dumps, mine; Arents; and bedrock escarpments. Small areas of Gilpin, Weikert, Hazleton, Ernest, Buchanan, Wharton, and Cavode soils are also included.

The permeability of these Udorthents ranges from moderately slow to rapid. The available water capacity is dominantly low or very low. Runoff is very rapid. These soils range from extremely acid to strongly acid. The hazard of erosion is severe or very severe.

Many areas of these soils are barren or have sparse stands of grasses, briars, and aspen. Trees, primarily conifers, have been planted on some areas. Some areas have been smoothed and seeded with grasses and legumes.

Slope and erosion make these soils generally unsuited to crops or pasture. If some areas are smoothed, they can be used for drought-resistant grasses and legumes. Lime and fertilizer will be needed. Some areas are suitable for trees, but slope limits the use of equipment.

The variability of the characteristics of this unit make onsite investigation necessary to determine the potentials and limitations of the unit for any use. Some areas are suitable for wildlife habitat, some types of recreation, and grasses and shrubs.

Capability subclass and woodland ordination: not assigned.

UcD—Udorthents, calcareous material, moderately steep. This unit consists of very channery or extremely channery, loamy soil material on ridgetops, side slopes, benches, and lowlands. The material is in areas that have been strip-mined for limestone or limestone and coal. The areas are dominantly near Portersville, Branchton, Harrisville, and Boyers. They are irregular in shape and range from 2 to 200 acres. Slopes are complex and irregular or smooth and range from 8 to 25 percent.

The thickness of the fill material ranges from several feet to more than 60 feet. The source of material is Titusville, Gresham, Wharton, Cavode, Gilpin, and Hazleton soils. The diameter of the rock fragments ranges from less than half an inch to 10 inches or more. They make up 30 to 95 percent of the material. They consist of shale, siltstone, sandstone, and limestone and small quantities of coal, carbonaceous shale, and parts of trees.

Included with these soils in mapping are small areas of nearly level, gently sloping, steep and very steep Udorthents and Arents and bedrock escarpments. Small areas of Gilpin, Titusville, Gresham, Hazleton, Wharton, and Cavode soils are also included.

The permeability of these Udorthents ranges from moderately slow to rapid. The available water capacity ranges from moderate to very low. The hazard of erosion is moderate to very severe. The soil ranges from moderately alkaline to extremely acid but mainly is neutral to strongly acid.

Many areas of these soils are barren or have a sparse to fairly dense cover of grasses, sweet clover, brairs, aspen, red maple, wild cherry, or black locust. Trees, primarily conifers, have been planted on some areas. Some areas have been regraded and seeded with grasses and legumes. Only a few small areas of these soils are used for crops.

In most areas these soils contain too many rock fragments and are too sloping to be used for crops. If some areas that are not too channery or too stony are smoothed and if intensive management practices are used, the soils can be used for crops and are fairly well suited to drought-resistant grasses and legumes. Lime and fertilizer and, in some areas, irrigation are needed. Conservation tillage, cover crops and grasses and legumes in the cropping system, stripcropping, and mixing crop residue into the surface layer will reduce runoff and control erosion.

If reclaimed areas are used for pasture, the main needs are lime and fertilizer, proper stocking rates, and rotation grazing.

Most areas of these soils are suitable for trees, but areas with complex slopes should be smoothed and lime and fertilizer are usually needed. Removing undesirable plants will conserve moisture and improve production. Machine planting on the larger, smoother areas that are not too channery or stony is generally practical.

The variability of the characteristics of this unit make onsite investigation necessary to determine the potentials and limitations of the unit for any use. Some areas are suitable for wildlife habitat, some types of recreation, and grasses and shrubs.

Capability subclass and woodland ordination: not assigned.

UcF—Udorthents, calcareous material, very steep. This unit consists of very channery and extremely channery, loamy soil material on ridgetops, hillsides, benches, and lowlands. The material is in areas that have been strip-mined for limestone or coal and limestone (fig. 11). The areas are dominantly in Portersville, Branchton, Harrisville, and Boyers. They are irregular in shape and range from 2 to 100 acres. Slopes are complex and irregular and range from 25 to 100 percent.

The thickness of the fill material ranges from several feet to more than 60 feet. The source of material is Titusville, Gresham, Wharton, Cavode, Gilpin, and Hazleton soils. The diameter of the rock fragments ranges from less than half an inch to 10 inches or more. They make up 30 to 95 percent of the material. They consist of shale, siltstone, sandstone, and limestone and small quantities of coal, carbonaceous shale, and parts of trees.

Included with these soils in mapping are small areas of nearly level to moderately steep Udorthents and Arents and bedrock escarpments. Small areas of Gilpin, Titusville, Gresham, Hazleton, Wharton, and Cavode soils are also included.

The permeability of these Udorthents ranges from moderately slow to rapid. The available water capacity ranges from moderate to very low. The hazard of erosion is moderate to very severe. The soil ranges from moderately alkaline to extremely acid but mainly is neutral to strongly acid.

Many areas of these soils are barren or have a sparse cover of grasses, briars, red maple, wild cherry, and black locust. Trees, primarily conifers and black locust, have been planted on some areas. Some areas have been smoothed and planted with grasses and legumes.

These soils are not suited to cropland or pasture because of steep and very steep slopes, many rock fragments, and a very severe erosion hazard.

If areas of these soils are smoothed, they can be used for drought-resistant grasses and legumes. The soils generally are suitable for trees, but slope limits the use of the equipment.

The variability of the characteristics of this unit make onsite investigation necessary to determine the potentials and limitations of the unit for any use. Some areas are suitable for wildlife habitat, some types of recreation, and grasses and shrubs.

Capability subclass and woodland ordination: not assigned.

UeB—Urban land-Ernest complex, 0 to 8 percent slopes. This unit is on footslopes, benches, and lowlands dominantly in the vicinity of Butler, but a few areas are throughout the county. The unit consists of nearly level and gently sloping areas of Urban land and very deep, moderately well drained Ernest soils. Slopes are smooth or concave. The areas are irregular in shape and range from 2 to 800 acres. The Urban land and Ernest soils are in such an intricate pattern that it was impractical to map them separately.

About 70 percent of this unit is Urban land. This part of the unit is covered by streets, parking lots, shopping centers, factories, houses, and other structures.

About 15 percent of this unit is areas of Ernest soils. Typically, they have a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is 47 inches thick and is mottled. The upper 15 inches of the subsoil is pale brown, friable to firm silt loam. The lower 32 inches is yellowish brown, very firm and brittle channery silty clay loam and channery silt loam. The substratum is brown, mottled, very firm channery silt loam to a depth of 60 inches or more. In many areas the surface layer and the upper part of the subsoil have been mixed or otherwise disturbed during urbanization.

Included with this unit in mapping are a few sloping, moderately steep, and steep areas; escarpments; and Arents. Also included are small areas of Gilpin, Brinkerton, Wharton, Cavode, Monongahela, Caneadea, Atkins, and Philo soils.

Drainage of most areas of this unit is by sewer systems and gutters. The permeability in the Ernest soils is moderate above the very firm part of the subsoil and moderately slow and slow in the very firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. The available water capacity is moderate, and runoff is slow or medium. In unlimed areas the soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the seasonal high water table and the very firm part of the subsoil.

The Ernest soils in this unit are in yards, lawns, cemeteries, parks, and other open areas.

The Ernest soils are well suited to vegetables, flowers, grasses, trees, and shrubs. Seasonal wetness is a limitation for gardens, landscaping, lawns, golf courses, and some other recreation areas.

Figure 11.—An area of Udorthents, calcareous material, very steep.

The seasonal high water table and slow or moderately slow permeability in the Ernest soils limit the unit as a site for waste disposal, buildings with basements, and intensively used recreation areas such as athletic fields. Foundation drains with proper outlets will help to prevent seepage of water into the basements of buildings on this soil. Onsite investigation is needed to determine the potentials and limitations of this unit for any use.

Capability subclass and woodland ordination: not assigned.

UeC—Urban land-Ernest complex, 8 to 15 percent slopes. This unit is on side slopes, foot slopes, and benches dominantly in the vicinity of Butler, but a few areas are throughout the county. The unit consists of strongly sloping areas of Urban land and very deep, moderately well drained Ernest soils. Slopes are smooth or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 30 acres. The Urban land and Ernest soils are in such an intricate pattern that it was impractical to map them separately.

About 70 percent of this unit is Urban land. This part of the unit is covered by streets, parking lots, buildings, and other structures.

About 15 percent of this unit is areas of Ernest soils. Typically, they have a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is 47 inches thick and is mottled. The upper 15 inches of the subsoil is pale brown, friable to firm silt loam. The lower 32 inches is yellowish brown, very firm and brittle channery silty clay loam and channery silt loam. The substratum is brown, mottled, very firm channery silt loam to a depth of 60 inches or more. In many areas the surface layer and the upper part of the subsoil have been mixed or otherwise disturbed during urbanization.

Included with this complex in mapping are a few small nearly level, gently sloping, moderately steep, and steep areas; Arents; and escarpments. Also included are small areas of Gilpin, Weikert, Hazleton, Wharton, Cavode, Monongahela, Caneadea, and Brinkerton soils.

Drainage of most areas of this unit is by sewer systems and gutters. The permeability in the Ernest soils is moderate above the very firm part of the subsoil and moderately slow and slow in the very firm part of the subsoil and in the substratum. The seasonal high water table is at a depth of 18 to 30 inches. The available water capacity is moderate, and runoff is medium to rapid. In unlimed areas the soil is strongly acid or very strongly acid throughout. Rooting depth is restricted by the seasonal high water table and the very firm part of the subsoil.

The Ernest soils in this unit are in yards, lawns, cemeteries, parks, and other open areas.

The Ernest soils in this unit are fairly well suited to vegetables, flowers, grasses, trees, and shrubs. Slope and seasonal wetness are the major limitations for gardens, landscaping, lawns, golf courses, and some other recreation areas.

Slope, the seasonal high water table and slow or moderately slow permeability in the Ernest soils, and a susceptibility to frost action limit the unit as a site for waste disposal, buildings, and recreation areas such as playgrounds and athletic fields. Foundation drains with proper outlets will help to prevent seepage of water into the basements of buildings on this soil. If these soils are disturbed for construction, management practices will be needed to control erosion and sedimentation. Onsite investigation is needed to determine the potentials and limitations of this unit for any use.

Capability subclass and woodland ordination: not assigned.

UgD—Urban land-Gilpin complex, 15 to 25 percent slopes. This unit is on hillsides dominantly in the vicinity of Butler. The unit consists of moderately steep areas of Urban land and moderately deep, well drained Gilpin soils. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres. The Urban land and Gilpin soils are in such an intricate pattern that it was impractical to map them separately.

About 70 percent of this unit is Urban land. This part of the unit is covered by streets, parking lots, buildings, and other structures.

About 15 percent of this unit is areas of Gilpin soils. Typically, they have a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown channery and very channery silt loam and silty clay loam about 22 inches thick. The substratum is yellowish brown and brown extremely channery silt loam 6 inches thick. Fractured siltstone bedrock is at a depth of about 36 inches. In many areas the surface layer and the upper part of the subsoil have been mixed or otherwise disturbed during urbanization.

Included with this unit in mapping are few small gently sloping, sloping, and steep areas; Arents; and escarpments. Also included are small areas of Weikert, Hazleton, Wharton, Cavode, and Ernest soils.

Drainage of most of the areas of this unit is by sewer systems and gutters. The permeability in the Gilpin soils is moderate, and the available water capacity is moderate to low. In unlimed areas the soil is strongly acid to extremely acid. Runoff is rapid or very rapid, and the hazard of erosion is very severe. Rooting depth is restricted by shale bedrock at a depth of 20 to 40 inches.

The Gilpin soils in this unit are in yards, lawns, parks, and other open areas.

The Gilpin soils are poorly suited to most types of flower and vegetable gardens and are fairly well suited to poorly suited grasses, trees, and shrubs for landscaping, golf courses, and some other recreation areas. Slope, the depth to bedrock, the hazard of erosion, and shale in the soil are the main limitations for those uses.

Slope and the depth to bedrock are the main limitations of the unit as a site for waste disposal, buildings, some recreation developments, and streets and roads. If this complex is disturbed for construction, management practices will be needed to control erosion and sedimentation. Onsite investigation is needed to determine the potentials and limitations of this unit for any use.

Capability subclass and woodland ordination: not assigned.

VcB—Vandergrift-Cavode silt loams, 3 to 8 percent slopes. This unit consists of gently sloping, deep, moderately well drained and somewhat poorly drained soils on ridgetops and benches in the southern half of the county. Slopes are smooth, convex, or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres. The Vandergrift and Cavode soils are in such an intricate pattern that it was impractical to map them separately.

The Vandergrift soils make up about 45 percent of this unit. Typically, they have a surface layer of reddish brown silt loam about 7 inches thick. The subsoil is 43 inches thick. The upper 8 inches of the subsoil is reddish brown, friable silty clay. The lower 35 inches is weak red, mottled, firm silty clay. The substratum is weak red channery and very channery silty clay loam 8 inches thick. Fractured dusky red shale bedrock is at a depth of 58 inches.

The Cavode soils make up about 35 percent of this unit. Typically, they have a surface layer of dark brown silt loam about 10 inches thick. This subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with these soils in mapping are small areas of nearly level and sloping Vandergrift and Cavode soils and small areas of soils similar to the Vandergrift and Cavode soils but with bedrock at a depth of less than 40 inches. Also included are small areas of Gilpin, Upshur, Weikert, Wharton, Ernest, and Brinkerton soils.

The permeability of the Vandergrift soils is slow in the subsoil and moderately slow and slow in the substratum. The permeability in the Cavode soils is slow. The seasonal high water table is at a depth of 6 to 18 inches in the Cavode soils and 6 to 30 inches in the Vandergrift soils. The available water capacity is moderate to high in both soils, and runoff is slow to medium. Unlimed areas of the Cavode soils are strongly acid or very strongly acid throughout. Unlimed areas of the Vandergrift soils are very strongly acid to slightly acid in the surface layer and subsoil and strongly acid to mildy alkaline in the substratum. Rooting depth is restricted by the seasonal high water table in each soil. The Vandergrift soils are particularly unstable and subject to slips and landslides.

Most areas of these soils are used for crops and pasture or are in native vegetation.

These soils are fairly well suited to corn and small grains and well suited to grasses and legumes that tolerate wetness. These soils dry and warm slowly in the spring. Fall-sown grains and alfalfa are subject to losses during winter because of frost heaving and wetness. Conservation tillage, cover crops and grasses and legumes in the cropping system, and graded or contour stripcropping will help to reduce runoff and control a moderate hazard of erosion. Diversions and grassed waterways on long slopes reduce runoff and help to control erosion. Subsurface drains will help to allow timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and reduce clodding and crusting.

These soils are well suited to pasture. Overgazing and grazing when they are wet are major pasture management concerns. The surface layer will become compacted if these soils are grazed when wet. Proper stocking rates, rotation grazing, and restricting grazing during wet seasons will help keep the pasture and soils in good condition.

These soils are suited to trees. Potential productivity is moderately high. The seasonal high water table and firmness of the subsoil restrict root development. Removing undesirable species will help increase production. The seasonal high water table limits the use of equipment during part of the year, but machine planting on large areas is usually practical.

The major limitations of these soils for most urban uses are the seasonal high water table, slow permeability, and unstable soil material. They especially limit the soils as a site for waste disposal, buildings, and roads and streets. The Vandergrift soils have a high shrink-swell potential, making them unstable and subject to slips and landslides. If these soils are disturbed for construction, management practices will be needed to relieve wetness, increase stability, and reduce erosion and sedimentation. These soils are suitable for wildlife habitat, some recreation areas, and grasses, and shrubs.

Capability subclass: IIIw; woodland ordination: 4W.

VcC—Vandergrift-Cavode silt loams, 8 to 15 percent slopes. This unit consists of strongly sloping, deep, and moderately well drained and somewhat poorly drained soils on side slopes and benches in the southern half of the county. Slopes are convex or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres. The Vandergrift and Cavode soils are in such an intricate pattern that it was impractical to map them separately.

The Vandergrift soils make up about 45 percent of this unit. Typically, they have a surface layer of reddish brown silt loam about 7 inches thick. The subsoil is 43 inches thick. The upper 8 inches of the subsoil is reddish brown, friable silty clay. The lower 35 inches is weak red, mottled, firm silty clay. The substratum is weak red channery and very channery silty clay loam 8 inches thick. Fractured dusky red shale bedrock is at a depth of 58 inches.

The Cavode soils make up about 35 percent of this unit. Typically, they have a surface layer of dark brown silt loam about 10 inches thick. This subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with these soils in mapping are small areas of gently sloping and moderately steep Vandergrift and Cavode soils and small areas of soils similar to the Vandergrift and Cavode soils but with bedrock at a depth of less than 40 inches. Also included are small areas of

Gilpin, Upshur, Weikert, Wharton, Ernest, and Brinkerton soils.

The permeability of the Vandergrift soils is slow in the subsoil and moderately slow and slow in the substratum. The permeability in the Cavode soils is slow. The seasonal high water table is at a depth of 6 to 18 inches in the Cavode soils and 6 to 30 inches in the Vandergrift soils. The available water capacity is moderate to high in both soils, and runoff is rapid. Unlimed areas of the Cavode soils are strongly acid or very strongly acid throughout. Unlimed areas of the Vandergrift soils are very strongly acid to slightly acid in the surface layer and subsoil and strongly acid to mildy alkaline in the substratum. Rooting depth is restricted by the seasonal high water table in each soil. The Vandergrift soils are particularly unstable and subject to slips and landslides.

Most areas of these soils are used for pasture and crops or are in native vegetation.

These soils are fairly well suited to poorly suited to corn and small grains, and they are well suited to grasses and legumes that tolerate wetness. The soils dry and warm slowly in the spring. Fall-sown grains and alfalfa are subject to losses during winter because of frost heaving and wetness. Contour stripcropping, grassed waterways, conservation tillage, and cover crops and using mainly grasses and legumes in the cropping system will reduce runoff and control a severe hazard of erosion. Subsurface drains will help to allow timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content and reduce clodding and crusting.

These soils are well suited to pasture. Overgazing and grazing when they are wet are major pasture management concerns. The surface layer will become compacted if these soils are grazed when wet. Proper stocking rates, rotation grazing, and restricting grazing during wet seasons will help keep the pasture and soils in good condition.

These soils are suited to trees. Potential productivity is moderately high. The seasonal high water table and firmness of the subsoil restrict root development. Removing undesirable species will help increase production. The seasonal high water table limits the use of equipment during part of the year, but machine planting on large areas is usually practical.

The major limitations of these soils for most urban uses are the seasonal high water table, slow permeability, and unstable soil material. They especially limit the soils as a site for waste disposal, buildings, and roads and streets. The Vandergrift soils have a high shrink-swell potential, making them unstable and subject to slips and landslides. If these soils are disturbed for construction, management practices will be needed to relieve wetness, increase stability, and reduce erosion and sedimentation. These soils are suitable for wildlife habitat, some recreation areas, grasses, and shrubs.

Capability subclass: IIIe; woodland ordination: 4W.

VcD—Vandergrift-Cavode silt loams, 15 to 25 percent slopes. This unit consists of moderately steep, deep, moderately well drained and somewhat poorly drained soils on hillsides and foot slopes in the southern half of the county. Slopes are smooth or convex. The areas are irregular in shape or long and narrow and range from 1 acre to 40 acres. The Vandergrift and Cavode soils are in such an intricate pattern that it was impractical to map them separately.

The Vandergrift soils make up about 40 percent of this unit. Typically, they have a surface layer of reddish brown silt loam about 7 inches thick. The subsoil is 43 inches thick. The upper 8 inches of the subsoil is reddish brown, friable silty clay. The lower 35 inches is weak red, mottled, firm silty clay. The substratum is weak red channery and very channery silty clay loam 8 inches thick. Fractured dusky red shale bedrock is at a depth of 58 inches.

The Cavode soils make up about 35 percent of this unit. Typically, they have a surface layer of dark brown silt loam about 10 inches thick. This subsoil is mottled and firm and is about 35 inches thick. The upper 4 inches of the subsoil is yellowish brown silty clay loam. The lower 31 inches is light brownish gray silty clay and clay. The substratum is dark yellowish brown and grayish brown, mottled channery silty clay loam to a depth of 60 inches or more.

Included with these soils in mapping are small areas of strongly sloping and steep Vandergrift and Cavode soils and small areas of soils similar to the Vandergrift and Cavode soils but that contain more rock fragments in the surface layer and subsoil and have bedrock at a depth of less than 40 inches. Small areas of Gilpin, Weikert, Hazleton, Cookport, Upshur, Wharton, Ernest soils are also included.

The permeability of the Vandergrift soils is slow in the subsoil and moderately slow and slow in the substratum. The permeability in the Cavode soils is slow. The seasonal high water table is at a depth of 6 to 18 inches in the Cavode soils and 6 to 30 inches in the Vandergrift soils. The available water capacity is moderate to high in both soils, and runoff is rapid or very rapid. Unlimed areas of the Cavode soils are strongly acid or very strongly acid throughout. Unlimed areas of the Vandergrift soils are very strongly acid to slightly acid in the surface layer and subsoil and strongly acid to mildy alkaline in the substratum. Rooting depth is restricted by the seasonal high water table in each soil. The Vandergrift soils are particularly unstable and subject to slips and landslides.

Most areas of these soils are used for pasture and woodland or are in native vegetation.

These soils are poorly suited to corn and small grains and fairly well suited to grasses and legumes that tolerate wetness. Contour stripcropping, grassed waterways, and crop rotations that consist mainly of grasses and legumes and cover crops will reduce runoff

and control a very severe hazard of erosion on cropland. Subsurface drains will reduce wetness caused by seeps and springs. Mixing crop residue into the surface layer will help to maintain organic matter content and reduce clodding and crusting.

These soils are fairly well suited to pasture. Overgrazing and grazing when they are wet are major pasture management concerns. The surface layer will become compacted if these soils are grazed when wet. Proper stocking rates, rotation grazing, and restricting grazing during wet seasons will help keep the pasture and soils in good condition.

These soils are suited to trees. Potential productivity is moderately high. The seasonal high water table and firmness of the subsoil restrict root development. Removing undesirable species will help to increase production. The seasonal high water table, slope, and clayey texture limit the use of equipment.

The major limitations of these soils for most urban uses are the slope, seasonal high water table, slow permeability, and unstable soil material. They especially limit the soils as a site for waste disposal, buildings, and roads and streets. The Vandergifts soils have a high shrink-swell potential, making them unstable and subject to slips and landslides. If these soils are disturbed for construction, management practices will be needed to relieve wetness, increase stability, and reduce erosion and sedimentation. The soils are suitable for wildlife habitat, some recreation areas, and grasses and shrubs.

Capability subclass: IVe; woodland ordination: 4W.

WaA—Wharton silt loam, 0 to 3 percent slopes. This soil is nearly level, deep, and moderately well drained. It is on broad upland flats and in slight depressions throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape and range from 1 acre to 30 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 37 inches thick. The upper 13 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 9 inches is brown, mottled, friable or firm silt loam. The lower 15 inches is dark yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, very firm channery silty clay loam 23 inches thick. Fractured shale bedrock is at a depth of about 69 inches.

Included with this soil in mapping are small areas of gently sloping Wharton soils and soils similar to this Wharton soil but with a subsoil of silty clay or clay. Also included are areas of Gilpin, Clymer, Ernest, Tilsit, Cookport, Cavode, Vandergrift, and Brinkerton soils.

The permeability of this Wharton soil is moderately slow or slow. The seasonal high water table is at a depth of 18 to 36 inches for long periods during wet seasons. In unlimed areas the soil is strongly acid or very strongly acid in the surface layer and subsoil and strongly acid to extremely acid in the substratum. The available water capacity is high. Runoff is slow or medium.

Most areas of this soil are used for crops. A few areas are in pasture and woodland.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. Wetness delays plowing and causes the soil to warm up slowly in the spring. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, cover crops, grasses and legumes in the cropping system, and grassed waterways help to control runoff and erosion. Mixing crop residue into the surface layer helps to increase organic matter content and reduce crusting and clodding.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for brief periods, but machine planting is practical on the larger areas.

The permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. Foundation drains help to prevent seepage into basements in this soil.

Capability subclass: IIw; woodland ordination: 4A.

WaB—Wharton silt loam, 3 to 8 percent slopes. This soil is gently sloping, deep, and moderately well drained. It is on broad, undulating ridgetops throughout all but the extreme northwest part of the county. Slopes are smooth or concave. The areas are irregular in shape and range from 1 acre to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 37 inches thick. The upper 13 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 9 inches is brown, mottled, friable or firm silt loam. The lower 15 inches is dark yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, very firm channery silty clay loam 23 inches thick. Fractured shale bedrock is at a depth of about 69 inches.

Included with this soil in mapping are small areas of nearly level and strongly sloping Wharton soils and soils similar to this Wharton soil but with a subsoil of silty clay or clay. Also included are areas of Gilpin, Clymer, Ernest, Tilsit, Cookport, Cavode, Vandergrift, and Brinkerton soils.

The permeability of this Wharton soil is moderately slow or slow. The seasonal high water table is at a depth of 18 to 36 inches for long periods during wet seasons. In unlimed areas the soil is strongly acid or very strongly

acid in the surface layer and subsoil and strongly acid to extremely acid in the substratum. The available water capacity is high. Runoff is slow or medium.

Most areas of this soil are used for crops. Some areas are used for pasture and woodland.

This soil is well suited to corn, vegetables, small grains, and grasses and legumes. Frost heaving and wetness damage some fall-sown grains and alfalfa during winter. Wetness delays plowing and causes the soil to warm slowly in the spring. Conservation tillage, cover crops and grasses and legumes in the cropping system, and graded or contour stripcropping will reduce runoff and control a moderate hazard of erosion. Graded rows, diversions, and grassed waterways help to improve surface drainage. Subsurface drains help to remove excess water and allow timely tillage. Mixing crop residue into the surface layer will help to maintain organic matter content, increase water infiltration, and reduce clodding and crusting.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees, and potential productivity is moderately high. Removal of undesirable species is a main management practice. The seasonal high water table restricts the use of equipment for brief periods, but machine planting is practical on the larger areas.

The permeability and the seasonal high water table limit the soil for most urban uses, especially as a site for waste disposal, buildings, and local roads and streets. Foundation drains help to prevent seepage into basements in this soil.

Capability subclass: IIe; woodland ordination: 4A.

WaC—Wharton silt loam, 8 to 15 percent slopes. This soil is strongly sloping, deep, and moderately well drained. It is on ridgetops and side slopes on undulating to hilly uplands throughout all but the extreme northwest part of the county. Slopes are smooth, convex, or concave. The areas are irregular in shape or long and narrow and range from 1 acre to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is 37 inches thick. The upper 13 inches of the subsoil is yellowish brown, friable silt loam that is mottled in the lower part. The next 9 inches is brown, mottled, friable or firm silt loam. The lower 15 inches is dark yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, very firm channery silty clay loam 23 inches thick. Fractured shale bedrock is at a depth of about 69 inches.

Included with this soil in mapping are small areas of gently sloping and moderately steep Wharton soils and soils similar to this Wharton soil but that contain shale throughout or have bedrock at a depth of less than 40 inches. Also included are small areas of Gilpin, Clymer, Hazleton, Tilsit, Ernest, Cavode, and Brinkerton soils.

The permeability of this Wharton soil is moderately slow or slow. The seasonal high water table is at a depth of 18 to 36 inches for long periods during wet seasons. In unlimed areas the soil is strongly acid or very strongly acid in the surface layer and subsoil and strongly acid to extremely acid in the substratum. The available water capacity is high. Runoff is rapid.

Most areas of this soil are used for crops and pasture. Some areas are used for woodland or are in native vegetation.

This soil is fairly well suited to corn and small grains and is well suited to grasses and legumes. Wetness and frost heaving damage some fall-sown grains and alfalfa during winter. The use of subsurface drainage helps to improve drainage and allow timely tillage. Conservation tillage, cover crops, grasses and legumes in the cropping system, diversions, and grassed waterways help to control runoff and control a severe hazard of erosion. Mixing crop residue into the surface layer helps to increase organic matter content and improve tilth.

This soil is well suited to pasture. Grazing when the soil is wet and overgrazing are the main pasture management concerns. Proper stocking rates, rotation grazing, and restricted grazing during wet periods will keep the pasture and soil in good condition.

This soil is suited to trees. Potential productivity is moderately high. Removing undesirable species will help increase productivity. The seasonal high water table sometimes limits the use of equipment for brief periods during wet seasons, but machine planting is practical on the larger areas.

The slope, seasonal high water table, and permeability are major limitations of this soil as a site for waste disposal and buildings with basements. Foundation drains and diversions help prevent seepage of water into basements. If this soil is disturbed for construction, practices will be needed to control erosion and sedimentation and to reduce wetness.

Capability subclass: IIIe; woodland ordination: 4R.

WhA—Wheeling silt loam, 0 to 3 percent slopes. This soil is nearly level, very deep, and well drained. It is on glacial outwash plains and terraces dominantly in the northwest part of the county. Slopes are smooth. The areas are irregular in shape and range from 5 to 100 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is 31 inches thick. The upper 21 inches of the subsoil is yellowish brown and brown, friable silt loam. The lower 10 inches is brown, strong brown, and dark yellowish brown, slightly firm loam and sandy loam. The substratum extends to a depth of 60 inches or more. It is dark yellowish brown and yellowish brown stratified loamy sand, sand, and gravel.

Included with this soil in mapping are small areas of gently sloping Wheeling soils and areas of Riverhead, Braceville, and Titusville soils.

The permeability of this Wheeling soil is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate to high. Runoff is slow. In unlimed areas this soil is strongly acid or moderately acid throughout.

Most areas of this soil are used for crops.

This soil is well suited to corn, vegetables, fruit, small grains, and grasses and legumes. Crops respond well to fertilizer and good management practices. Conservation tillage, cover crops, and mixing crop residue into the surface layer will help maintain organic matter content, reduce runoff, control erosion, and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

This soil is suited to trees. Potential productivity is moderately high. Machine planting is practical on large areas.

The soil has few limitations for urban uses. The rapid permeability in the substratum causes a hazard of ground-water contamination in areas of this soil used for onsite waste disposal or for sanitary landfills.

Capability class: I; woodland ordination: 4A.

WhB—Wheeling silt loam, 3 to 8 percent slopes. This soil is gently sloping, very deep, and well drained. It is on glacial outwash plains and terraces dominantly in the northwest part of the county. Slopes are smooth and convex. The areas are irregular in shape and range from 2 to 100 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is 31 inches thick. The upper 21 inches of the subsoil is yellowish brown and brown, friable silt loam. The lower 10 inches is brown, strong brown, and dark yellowish brown, slightly firm loam and sandy loam. The substratum extends to a depth of 60 inches or more. It is dark yellowish brown and yellowish brown stratified loamy sand, sand, and gravel.

Included with this soil in mapping are a few small areas of nearly level and sloping Wheeling soils and areas of Riverhead, Braceville, and Titusville soils.

The permeability of this Wheeling soil is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate to high. Runoff is medium. In unlimed areas this soil is strongly acid or moderately acid throughout.

Most areas of this soil are used for crops.

This soil is well suited to corn, vegetables, fruit, small grains, and grasses and legumes. Crops respond well to fertilizer and good management practices. Stripcropping, diversions, grassed waterways, conservation tillage, and the cover crops and grasses and legumes in the cropping system will reduce runoff and control erosion. Mixing crop residue into the surface layer will help maintain organic matter content and improve tilth.

This soil is well suited to pasture. Proper stocking rates and rotation grazing are the chief management needs. Fertility can be maintained by periodic applications of nutrients.

This soil is suited to trees. Potential productivity is moderately high. Machine planting is practical on large areas.

The soil has few limitations for urban uses. The rapid permeability in the substratum causes a hazard of ground-water contamination in areas of this soil used for onsite waste disposal or for sanitary landfills.

Capability subclass: IIe; woodland ordination: 4A.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. Identification of prime farmland is a major step in meeting the Nation's needs for food and fiber.

The U.S. Department of Agriculture defines prime farmland as the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while using acceptable farming methods. Prime farmland produces the highest yields and requires minimal amounts of energy and economic resources, and farming it results in the least damage to the environment.

An area identified as prime farmland must be used for producing food or fiber or must be available for those uses. Thus, urban and built-up land and water areas are not classified as prime farmland.

The general criteria for prime farmland are as follows: a generally adequate and dependable supply of moisture from precipitation or irrigation, favorable temperature and growing-season length, acceptable levels of acidity or alkalinity, few or no rocks, and permeability to air and water. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not flooded during the growing season. The slope range is mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

The survey area contains about 82,775 acres of prime farmland. That acreage makes up about 16.3 percent of the total acreage in the survey area and is throughout the county.

The soil map units that make up prime farmland in the survey area are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location of each unit is shown on the detailed soil maps at the back of this publication. The soil properties and characteristics that affect use and management of the units are described in the section "Detailed Soil Map Units."

Some soils in table 5 are classified as prime farmland if certain limitations of the soil are overcome. The measures needed to overcome the limitations of such soils are given in parentheses after the name of the map unit.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

John C. Spitzer, agronomist, Soil Conservation Service, assisted with the preparation of this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Farming is a major land use in Butler County. According to 1978 Census of Agriculture, 110,329 acres was used for crops and pasture (*13*). Of this total, 8,693 acres was used for permanent pasture. The 1981 Pennsylvania Crop and Livestock Annual Summary for the county reported 24,050 acres of corn, 15,500 acres of small grain, 38,500 acres of alfalfa and other hay and 400 acres of potatoes, 1,128 acres in orchards and vegetables and the rest in cropland pasture, idle cropland, or other uses (*12*).

Soil erosion in these and other areas results in sediment deposition in streams and reservoirs and causes loss of productive topsoil.

Conservation and erosion-control practices provide protective cover, reduce surface water runoff and sedimentation, and increase infiltration. Cropping systems that maintain a plant cover help to protect the soils. Deferred grazing and the use of grasses and legumes on areas used for hay and pasture help to reduce erosion, provide nitrogen, and improve tilth. Contour farming, terraces, conservation tillage, cover crops, and incorporating crop residue into the soil help to increase infiltration and reduce erosion on cultivated areas. These practices are suited to most soils except those with steep and irregular slopes, which are not suitable for terraces.

Terraces and diversions reduce the length of slopes and result in reducing surface water runoff and erosion. The use of terraces is practical on deep and very deep, well drained soils with moderate, uniform slopes. Clymer, Hazleton, and Wheeling soils are examples of soils suitable for terraces and diversions. Contour farming and stripcropping are also suited to soils with moderate, uniform slopes. Gilpin, Tilsit, and Wharton soils are examples.

Soil drainage is a major management concern on some of the soils in Butler County. A few of the soils, for example Brinkerton, Canadice, and Frenchtown soils, are

so wet that crop production is not practical or economically feasible without artificial drainage.

The somewhat poorly drained soils are so wet that crop damage results during most years unless artificial drainage is used. Examples in this category are Cavode and Gresham soils.

Some small, wet areas are in drainageways and swales. These small areas are generally within larger areas of moderately well drained Ernest and Buchanan soils. Artificial drainage could improve the management and productivity of most of these small areas, but installing drainage may not be economically feasible.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is usually needed for poorly drained soils that are intensively farmed. Drains must be more closely spaced in the soils with slow permeability than in others that are more permeable. In addition, finding adequate outlets for tile drainage systems is often difficult. Canadice, Frenchtown, Atkins, and Brinkerton are examples of soils with slow permeability and poor drainage.

Some soils used for crop production in the survey area have a low content of organic matter. Generally, the structure of such soils is weak, and intensive rainfall commonly results in crusting of the surface when the soil dries. The crust usually is hard and nearly impervious to water, and it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help to improve soil structure and reduce crust formation.

Generally, fall plowing is not considered to be an effective practice on soils with a surface layer that is silt loam and has a low organic matter content. Fall plowing commonly results in the formation of a crust during the winter and spring. Many soils are nearly as dense and hard at planting time after fall plowing as they were before they were plowed. In addition, sloping soils are subject to accelerated erosion if they are plowed in the fall.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. The levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

William H. Clifton, forester, Soil Conservation Service, assisted with the preparation of this section.

Butler County has approximately 256,600 acres of forestland. This amounts to 50 percent of the total land area in the county. Most of the forestland is classified as commercial, and nearly all of that is privately owned.

Stands of second- and third-growth trees make up the forestland. The forest types of Butler County generally do not fit into precise categories. Most of the types are in transition from the northern to southern hardwood types and from eastern to central types. The major forest types in the county and the extent of each, as given by the USDA Forest Service and the Pennsylvania Bureau of Forestry, are as follows:

Softwood types make up 5 percent of the total commercial forestland in the county. This type contains a small remnant of the white pine-hemlock group, which is mostly in eastern Butler County on steep slopes adjacent to streams, and the scotch pine and red pine groups. The common associates of the white pine-hemlock group are red maple, red oaks, white oaks, beech, black cherry, and aspen. The scotch pine and red pine groups are primarily planted stands. Their common associates are Norway spruce, white pine, Austrian pine, and Japanese or European larch.

Oak types are on 29 percent of the commercial forestland. This type contains the oak-pine and oak-hickory groups. The common associates of the oak-pine group are white ash, sweet birch, black cherry, sugar maple, red maple, yellow-poplar, and Virginia pine.

Northern hardwood types make up the remaining 66 percent of the commercial forestland in Butler County. There is very little of the beech-birch-maple group in this type, but the red maple is extensive. The common associates of the red maple group are sugar maple, red oak, black cherry, white ash, aspen, and tulip poplar.

Sawtimber makes up about 44 percent of the acreage in commercial forestland and poletimber 26 percent. The other 30 percent is in seedling and sapling stands and stands classified as less than 10 percent stocked with growing stock trees.

In general, the soils in the county are capable of supporting good stands of red oak, black cherry, yellow-poplar, white pine, and sugar maple. Trees grow better on the deep, well drained soils than on the poorly drained soils.

A forest owner can encourage the growth of desirable trees by using good management practices on the areas where the soils are rated very high, high, and moderately high for potential productivity.

The management needed to increase yields of wood crops on those soils rated low for potential productivity generally is not economically practical. However, woodland is in many cases the most practical use for those soils because they have equally unfavorable characterictics for crops and grasses.

Soils that are rated *moderate* for potential productivity are the most difficult to appraise for management of wood crops. A thorough inventory of quantity and quality of the growing stock on the site is needed. The market potential for the species and whether the soils rated moderate are mixed with larger areas of more productive soils will help to determine if management is economically feasible.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed in the tables. The table gives the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, that the indicator species can produce. The larger the number, the greater the potential productivity. The number 1 indicates low productivity; 2 and 3, *moderate*; 4 and 5, moderately high; 6 through 8, high; 9 through 11, very high; and 12 or more, extremely high. The second part of the symbol,

a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates steep slopes; *W*, excessive water in or on the soil; *D*, restricted rooting depth caused by bedrock, hardpan, or other restrictive layer; *C*, clay in the upper part of the soil; *F*, large amounts of rock fragments in the soil; and *A*, no significant limitations. If a soil has more than one limitation, the priority is as follows: W, D, C, R, F, and A.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that erosion can occur as a result of site preparation or following cutting operations and where the soil is exposed, for example, roads, skid trails, fire lanes, and log handling areas. Forests that are abused by fire or overgrazing are also subject to erosion. The ratings for the erosion hazard are based on the percent of the slope and on the erosion factor K shown in table 16. A rating of *slight* indicates that no particular measures to prevent erosion are needed under ordinary conditions. A rating of *moderate* indicates that erosion control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

The proper construction and maintenance of roads, trails, landings, and fire lanes will help overcome the erosion hazard.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that equipment use normally is not restricted either in kind of equipment that can be used or time of year because of soil factors. If soil wetness is a factor, equipment use can be restricted for a period not to exceed 2 months. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If soil wetness is a factor, equipment use is restricted for 2 to 6 months. A rating of *severe* indicates that equipment use is severely restricted either in kind of equipment or season of use. If soil wetness is a factor, equipment use is restricted for more than 6 months.

Choosing the most suitable equipment and timing harvesting and other management operations to avoid seasonal limitations help overcome the equipment limitation.

Seedling mortality refers to the probability of death of naturally occuring or planted tree seedlings as influenced by kinds of soil or topographic conditions. The factors considered in rating the soils for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and aspect of the slope. A rating of *slight* indicates that under usual conditions the expected mortality is less than 25 percent. A rating of *moderate* indicates that the expected mortality is 25 to 50 percent. Extra precautions are advisable. A rating of *severe* indicates that the expected mortality is more than 50 percent. Extra precautions are important. Replanting may be necessary.

The use of special planting stock and special site preparation, such as bedding, furrowing, or surface drainage, can help reduce seedling mortality.

Windthrow hazard is the likelihood of trees being uprooted (tipped over) by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions are a seasonal high water table and bedrock or a fragipan or other limiting layer. A rating of *slight* indicates that normally no trees are blown down by the wind. Strong winds may break trees but do not uproot them. A rating of *moderate* indicates that moderate or strong winds occasionally blow down a few trees during periods of soil wetness. A rating of *severe* indicates that moderate or strong winds may blow down many trees during periods of soil wetness.

The use of specialized equipment that does not damage surficial root systems during partial cutting operations can help reduce windthrow. Care in thinning or no thinning also can help reduce windthrow.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Common trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, represents an expected volume produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand. One cubic meter per hectare equals 14.3 cubic feet per acre.

The first tree species listed under common trees for a soil is the indicator species for that soil. The indicator species is the species that is common in the area and is generally the most productive on the soil. The productivity class of the indicator species is the number used for the ordination symbol.

Trees to plant are those that are suited to the soil and are planted for commercial wood production.

Recreation

About 28,000 acres, or 5.5 percent of the county, is used primarily for public outdoor recreation. The major activities at these areas and in some private areas are golfing, picnicking, camping, hiking, swimming, horseback riding, tennis, hunting, fishing, and boating.

Moraine State Park, in the west-central part of the county, has a total area of about 15,800 acres. Lake Arthur extends through the central part of the park. It has an area of 3,225 acres and occupies lowland that was once a large glacial lake. Together, the park and the lake provide opportunities for picnicking, swimming, boating, fishing, hiking, horseback riding, nature study, hunting, and snowmobiling. A paved 7-mile trail along the north shore of the lake is used by bicyclists, joggers, and hikers.

There are more than 8,600 acres of State game lands in the county, mainly in the northeastern part. These lands are maintained by the Pennsylvania Game Commission for wildlife habitat and propagation, game food plots, and public hunting, hiking, and nature study. The Glades Waterfowl Area near Moniteau has a 300-acre lake that is managed by the Game Commission for waterfowl propagation and observation.

The Pennsylvania Fish Commission maintains a 146-acre park east of Glade Mills in the south-central part of the county. In the park is the 50-acre Glade Run Lake, which provides an area for fishing and boating. The Jennings Nature Reserve, a 300-acre area owned by the Western Pennsylvania Conservancy and leased by Slippery Rock State College, is maintained for public nature study and hiking.

Soils that are very deep and deep, well drained, and nearly level and gently sloping are generally suitable for recreation areas such as athletic fields, camping areas, and picnic grounds. Soils that are strongly sloping or gently sloping or that are seasonally wet are generally suitable for golf courses, hiking trails, hunting, and other types of recreation that require only slight land alteration. The soils that are steep or very steep or that are poorly drained are suitable for nature study and esthetic purposes.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Stephen A. Miller, wildlife biologist, Soil Conservation Service, helped to prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect

the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggartick, daisy fleabane, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, birch, cherry, maple, apple, hawthorn, dogwood, hickory, blackberry, and blueberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, yew, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, arrowhead, burreed, pickerel weed, rushes, cattail, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include meadow vole, mourning dove, field sparrow, eastern cottontail, and killdeer.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, gray squirrel, and white-tail deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife species attracted to such areas are wood duck, mallard, muskrat, common snipe.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water

management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil),

shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or

soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a

percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

Some soils in table 17 are assigned to two hydrologic soil groups. Dual grouping is used for one of two reasons: (1) Some soils have a seasonal high water table but can be drained. In this instance the first letter applies to the drained condition of the soil and the second letter to the undrained condition. (2) In some soils that are less than 20 inches deep to bedrock, the first letter applies to areas where the bedrock is cracked and pervious and the second letter to areas where the bedrock is impervious or where exposed bedrock makes up more than 25 percent of the surface of the soil.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional, common,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *Common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely, grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched, artesian,* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally

below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain plus *aquent,* the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, acid, mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*10*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*11*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Andover Series

The soils of the Andover series are fine-loamy, mixed, mesic Typic Fragiaquults. They are very deep and poorly drained and are on foot slopes and benches and in depressions and lowlands throughout all but the extreme northwest part of the county. The soils formed in colluvium from acid gray and brown sandstone that is interbedded with shale and siltstone. Slope ranges from 0 to 15 percent.

Andover soils are on uplands near well drained Hazleton, Gilpin, and Clymer soils and moderately well

drained Cookport and Buchanan soils and are near poorly drained Atkins soils that are on flood plains.

Typical pedon of Andover loam, 3 to 8 percent slopes, in a field in Venango Township, 1.5 miles east of Boyers in the State Game Lands, 400 feet south of Legislative Route 10070, 0.1 mile east of Township Route 536, and 0.9 mile west of Township Route 504:

Ap—0 to 10 inches, dark grayish brown (10YR 4/2) loam; common fine faint grayish brown (10YR 5/2) and brown (10YR 4/3) mottles; weak fine granular structure; friable, nonsticky, nonplastic; 5 percent rock fragments; moderately acid; abrupt wavy boundary.

Btg—10 to 21 inches, grayish brown (10YR 5/2) loam; common fine distinct brown (10YR 5/3) and pale brown (10YR 6/3) mottles; weak thick platy structure parting to moderate fine subangular blocky; friable to firm, slightly sticky, slightly plastic; common distinct clay films on faces of peds and lining pores; 10 percent rock fragments; strongly acid; clear wavy boundary.

Btxg—21 to 42 inches, grayish brown (10YR 5/2) sandy clay loam; many fine distinct light gray (10YR 7/2), brown (10YR 5/3 and 7.5YR 4/4), and yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure parting to moderate thick and medium platy and weak fine angular blocky; very firm, brittle, slightly sticky, slightly plastic; common distinct clay films on faces of peds and lining pores; gray (10YR 6/1) prism coatings; 10 percent rock fragments; strongly acid; gradual wavy boundary.

C—42 to 62 inches, brown (10YR 5/3) channery sandy loam; few pockets and thin strata of loam and loamy sand; many medium and coarse prominent yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), dark grayish brown (10YR 4/2), and gray (10YR 5/1) mottles; massive; very firm to firm, nonsticky, nonplastic; 20 percent rock fragments; strongly acid.

The solum ranges from 40 to 55 inches in thickness. The depth to the fragipan ranges from 16 to 28 inches. The depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 40 percent in individual horizons in the solum and from 10 to 50 percent in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. In uncultivated areas the A horizon is black, very dark gray, or very dark grayish brown. The E horizon is brown, dark grayish brown, or grayish brown.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2, and it is mottled. It is loam, clay loam, or sandy clay loam in the fine earth. Some pedons have a BE horizon.

The Bx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6, and it is mottled. Prism faces and smaller ped faces are light gray to dark grayish brown. The Bx horizon is loam, clay loam, or sandy clay loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 1 to 4, and it is mottled. It ranges from sandy loam to sandy clay loam in the fine earth.

Arents

Arents consist of shallow to very deep, moderately well drained to somewhat excessively drained soils in excavated areas and filled areas used as sites for highways, industries, and urban developments. Arents are on ridgetops, side slopes, benches, and flood plains throughout the county. Slope ranges from 0 to 100 percent.

Arents are on the landscape with Gilpin, Weikert, Hazleton, Wharton, Cavode, Brinkerton, Atkins, and other soils.

Arents are so variable that a typical pedon is not given. The soils do not have horizons because they have been deeply mixed by earth-moving operations. They contain fragments of A, E, and B horizons that can be identified as parts of other soils. These horizon fragments are throughout the soil and are mixed with the material from other horizons. Below a depth of 40 inches in some pedons are relatively undisturbed soils or parts of soils.

The depth to bedrock is 12 inches or more. The content of rock fragments ranges from 0 to 99 percent throughout the soil. The reaction has a wide range but dominantly is slightly acid to extremely acid.

The color is variable, but Arents mainly have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. The texture of the fine earth ranges from sand to clay, but it is dominantly sandy loam to silty clay loam.

Atkins Series

The soils of the Atkins series are fine-loamy, mixed, acid, mesic Typic Fluvaquents. They are very deep and poorly drained and are on flood plains throughout the county. They formed in alluvium from acid sandstone, siltstone, and shale. Slope ranges from 0 to 3 percent.

Atkins soils are on uplands near moderately well drained Ernest and Buchanan soils and poorly drained Brinkerton, Canadice, and Andover soils. They are on flood plains near well drained Pope soils and moderately well drained Philo soils.

Typical pedon of Atkins silt loam, in an abandoned pasture on the east bank of Big Run in Moraine State Park, 1.5 miles northwest of Prospect, and 3.5 miles east of Portersville, 700 feet southwest of old US 422 and 0.75 mile west-northwest of the intersection of old US 422 and PA 528:

Ap—0 to 8 inches, dark grayish brown (2.5Y 4/2) silt loam; moderate medium granular structure; friable, slightly sticky, nonplastic; moderately acid; abrupt smooth boundary.

Eg—8 to 11 inches, olive gray (5Y 4/2) silt loam; common fine faint grayish brown (2.5Y 5/2) mottles; weak thin platy structure parting to weak medium granular; friable, slightly sticky, nonplastic; very strongly acid; clear broken boundary.

BEg—11 to 20 inches, olive gray (5Y 5/2) silt loam; common fine distinct dark yellowish brown (10YR 4/4) and gray (N 5/0) mottles; weak medium platy structure parting to weak fine granular; friable, slightly sticky, slightly plastic; very strongly acid; clear wavy boundary.

Bg1—20 to 33 inches, olive gray (5Y 5/2) silt loam; many medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; friable to slightly firm, slightly sticky, slightly plastic; common black concretions; very strongly acid; gradual wavy boundary.

Bg2—33 to 41 inches, olive gray (5Y 5/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly firm, slightly sticky, plastic; common black concretions; very strongly acid; clear wavy boundary.

BCg—41 to 47 inches, olive gray (5Y 5/2) silt loam; common medium prominent strong brown (7.5YR 5/6), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm, slightly sticky, slightly plastic; many black concretions; very strongly acid; abrupt irregular boundary.

C—47 to 65 inches, yellowish brown (10YR 5/4) loam; lenses of grayish brown (2.5Y 5/2) clay loam; common medium and fine distinct strong brown (7.5YR 5/6), dark brown (7.5YR 3/2), olive gray (5Y 5/2), and black (5Y 2/1) mottles; massive; firm, slightly sticky, slightly plastic; very strongly acid.

The solum thickness ranges from 30 to 50 inches, and the depth to bedrock is more than 60 inches. Rock fragments are not common, but in some pedons their content is as much as 20 percent in the solum and as much as 35 percent in the C horizon. The reaction in unlimed areas is strongly acid or very strongly acid throughout.

The A horizon has hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is commonly mottled.

The E horizon has a hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is commonly mottled.

The B horizon has hue of 10YR or 5Y or is neutral, has value of 4 to 6, and has chroma of 0 to 2. It is mottled. The dominant chroma to a depth of 30 inches depends upon the hue and value. If the hue is 10YR or 2.5YR and the value is 6, the chroma is 0 to 2. If the value is 4 or 5, the chroma is 0 or 1. If the hue is 5Y, the chroma is 0 to 2. The B horizon mainly is silt loam, but ranges from silty clay loam to sandy loam.

The C horizon has hue of 10YR to 5Y or is neutral, has value of 5 or 6, and has chroma of 0 to 6. It is weakly stratified and ranges mainly from silty clay loam to sandy loam in the fine earth. Stratified sand and gravel are in some pedons below a depth of 40 inches.

Braceville Series

The soils of the Braceville series are coarse-loamy, mixed, mesic Typic Fragiochrepts. They are very deep and moderately well drained and are on smooth and undulating outwash plains, kames, terraces, and moraines in the northwest part of the county. The soils formed in glacial outwash consisting primarily of stratified sand and gravel. Slope ranges from 0 to 15 percent.

Braceville soils are on landscapes with well drained Riverhead and Wheeling soils, somewhat poorly drained and poorly drained Fredon soils, and poorly drained Frenchtown soils.

Typical pedon of Braceville loam, 3 to 8 percent slopes, in an abandoned hay field in Moraine State Park, 4 miles northeast of Portersville, 390 feet west of the farm lane and 600 feet northwest of its intersection with Township Route 370, 1,000 feet southwest of the intersection of Township Routes 370 and 368:

Ap—0 to 8 inches, dark brown (10YR 3/3) loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; 5 percent rock fragments; moderately acid; abrupt smooth boundary.

Bw—8 to 17 inches, dark yellowish brown (10YR 4/4) fine sandy loam; few medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; 5 percent rock fragments; moderately acid; abrupt wavy boundary.

Bx1—17 to 23 inches, dark brown (7.5YR 4/4) gravelly sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting weak very thick and thick platy and weak medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; common faint clay bridges between sand grains and few faint patches of clay films on faces of peds; common black coatings; 30 percent rock fragments; slightly acid; clear wavy boundary.

Bx2—23 to 33 inches, dark brown (7.5YR 4/4) very gravelly sandy loam; common coarse distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure parting to very weak medium subangular blocky, some tendency toward platiness; firm, brittle; nonsticky, nonplastic; very few faint clay films in pores and few

faint clay bridges between sand grains on faces of peds; 40 percent rock fragments; moderately acid; gradual wavy boundary.

C1—33 to 45 inches, yellowish brown (10YR 5/4) extremely gravelly loamy sand; single grain; loose, nonsticky, nonplastic; 60 percent rock fragments; strongly acid; gradual wavy boundary.

C2—45 to 59 inches, yellowish brown (10YR 5/4) gravelly sandy loam; massive; very friable, nonsticky, nonplastic; 35 percent rock fragments; strongly acid; abrupt smooth boundary.

C3—59 to 72 inches, brown (10YR 5/3) sand; single grain; loose, nonsticky, nonplastic; 3 percent rock fragments; strongly acid.

The solum ranges from 30 to 55 inches in thickness. The depth to the fragipan ranges from 15 to 30 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 30 percent above the fragipan and from 20 to 50 percent in the fragipan. The depth to stratified sand and gravel ranges from 30 to 72 inches. The reaction in unlimed areas ranges from very strongly acid to moderately acid above the Bx horizon and from strongly acid to slightly acid in the Bx and C horizons.

The Ap horizon has hue of 7.5YR to 2.5Y, value of 3 or 4, and chroma of 2 to 4.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is mottled. It ranges from silt loam to sandy loam in the fine earth.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is mottled. It ranges from silt loam to sandy loam in the fine earth.

The C horizon is neutral or has hue of 5YR to 5Y, value of 4 to 6, and chroma of 0 to 6. It is stratified and ranges from silt loam to sand in the fine earth.

Brinkerton Series

The soils of the Brinkerton series are fine-silty, mixed, mesic Typic Fragiaqualfs. They are very deep and poorly drained soils and are on lowlands, in depressions, and on benches throughout all but the extreme northwest part of the county. The soils formed in colluvium from acid gray and brown shale and siltstone. Slope ranges from 0 to 15 percent.

Brinkerton soils are on uplands near well drained Gilpin and Weikert soils, moderately well drained Wharton, Tilsit, and Ernest soils, and somewhat poorly drained Cavode soils. They are near poorly drained Atkins soils on flood plains.

Typical pedon of Brinkerton silt loam, 3 to 8 percent slopes, in a pasture 2 miles south of Saxonburg, on the west side of Township Route 552, midway between its intersection with Legislative Route 10139 and Township Route 559:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; very friable, slightly sticky, slightly plastic; 2 percent rock fragments; neutral; abrupt smooth boundary.

Btg1—9 to 14 inches, light brownish gray (2.5Y 6/2) silt loam; common medium and fine distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; weak medium platy structure parting to moderate fine angular and subangular blocky; friable, slightly sticky, slightly plastic; common distinct clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; clear wavy boundary.

Btg2—14 to 20 inches, light brownish gray (2.5Y 6/2) silt loam; common medium and fine distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; moderate medium angular blocky structure; friable, slightly sticky, slightly plastic; continuous distinct clay films on faces of peds and in pores; 10 percent rock fragments; very strongly acid; clear wavy boundary.

Btxg1—20 to 30 inches, gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate coarse and medium angular blocky; firm, brittle, sticky, plastic; common distinct clay films on faces of peds and in pores; continuous prominent light gray (10YR 7/1) coatings on prisms and smaller peds; 2 percent rock fragments; very strongly acid; gradual wavy boundary.

Btxg2—30 to 48 inches, gray (10YR 6/1) channery silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate coarse angular blocky and moderate thick platy; very firm, brittle, sticky, slightly plastic; continuous distinct clay films on faces of peds and in pores; continuous prominent light gray (10YR 7/1) coatings on prisms and smaller peds; 15 percent rock fragments; very strongly acid; gradual wavy boundary.

Cg—48 to 60 inches, brown (10YR 4/3) channery silt loam; common medium distinct gray (10YR 6/1) mottles; weak very coarse prismatic structure; firm, sticky, slightly plastic; 30 percent rock fragments; strongly acid.

The solum ranges from 40 to 50 inches in thickness. The depth to the fragipan ranges from 15 to 30 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 10 percent above the fragipan, from 0 to 20 percent in the fragipan, and from 10 to 90 percent in the C horizon. The reaction in unlimed areas ranges from very strongly acid to moderately acid in the solum and from strongly acid to slightly acid in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is mottled. It is silt loam or silty clay loam. Some pedons have a BE horizon.

The Bx horizon is neutral or has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 0 to 2. It is mottled. It is silt loam, loam, clay loam, or silty clay loam in the fine earth.

The C horizon is neutral or has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 0 to 3. It is mottled. It is silt loam, loam, clay loam, or silty clay loam in the fine earth.

Buchanan Series

The soils of the Buchanan series are fine-loamy, mixed, mesic Aquic Fragiudults. They are very deep and moderately well drained and are on foot slopes, on benches, in depressions, and on lowlands throughout all but the extreme northwest part of the county. The soils formed in colluvium from acid brown and gray sandstone interbedded with shale and siltstone. Slope ranges from 0 to 25 percent.

Buchanan soils are on the landscape with well drained Hazleton, Clymer, and Gilpin soils, moderately well drained Cookport soils, and poorly drained Andover soils. The Buchanan soils have a thicker solum than the Cookport soils.

Typical pedon of Buchanan loam, in an area of Buchanan loam, 8 to 25 percent slopes, very stony, in woodland on the Pennsylvania State Game Lands, 2 miles southeast of Boyers, 1 mile north of Whiskerville, in a road cut on the north side of Township Route 504, midway between the spring and the southern boundary of the game lands:

O1—3 inches to 1 inch, mat of fresh and slightly decayed leaves, twigs, bark, and roots.

O2—1 inch to 0, black (10YR 2/1) decayed organic material and humus containing twigs, roots, and rock fragments.

A—0 to 2 inches, very dark gray (10YR 3/1) loam; weak fine granular structure; very friable, slightly sticky, nonplastic; 5 percent rock fragments; strongly acid; abrupt irregular boundary.

E—2 to 6 inches, brown (10YR 4/3) loam; weak fine granular structure; very friable, slightly sticky, nonplastic; 10 percent rock fragments; very strongly acid; clear wavy boundary.

BE—6 to 16 inches, yellowish brown (10YR 5/4) loam; weak fine and very fine subangular blocky structure; very friable, slightly sticky, nonplastic; 5 percent rock fragments; extremely acid; gradual wavy boundary.

Bt1—16 to 24 inches, yellowish brown (10YR 5/4) loam or clay loam; weak fine angular and subangular blocky structure showing some platiness; friable, slightly sticky, slightly plastic; common distinct clay films on faces of peds; 5 percent rock fragments; very strongly acid; clear wavy boundary.

Bt2—24 to 29 inches, brown (10YR 5/3) clay loam; common fine distinct strong brown (7.5YR 5/8), grayish brown (10YR 5/2), and yellowish brown (10YR 5/4) mottles; moderate medium and thin platy and fine subangular blocky structure; friable, slightly sticky, slightly plastic; continuous distinct clay films on faces of peds and in pores; dark grayish brown (10YR 4/2) ped coatings; 10 percent rock fragments; very strongly acid; clear wavy boundary.

Btx1—29 to 38 inches, brown (10YR 4/3) channery clay loam; many medium and fine prominent gray (N 5/0), strong brown (7.5YR 5/8), and dark grayish brown (10YR 4/2) mottles; moderate medium prismatic structure parting to moderate thick platy and moderate medium angular blocky; very firm, brittle, slightly sticky, plastic; continuous distinct clay films on faces of peds and in pores; gray (10YR 5/1) prism coatings; 25 percent rock fragments; very strongly acid; clear irregular boundary.

Btx2—38 to 60 inches, dark yellowish brown (10YR 4/4) very channery loam; many medium and fine distinct grayish brown (10YR 5/2) and brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; very firm, brittle, slightly sticky, slightly plastic; common distinct clay films on faces of peds; grayish brown (2.5Y 5/2) and dark grayish brown (10YR 4/2) ped coatings; 50 percent rock fragments; very strongly acid; gradual irregular boundary.

C—60 to 64 inches, grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) very channery sandy loam; weak coarse subangular blocky structure; firm, slightly sticky, nonplastic; 60 percent rock fragments; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to the fragipan ranges from 20 to 36 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 5 to 40 percent in individual horizons above the fragipan and from 10 to 60 percent in the fragipan and C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 to 4.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 4.

The BE and Bt horizons have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. Mottling begins in the upper 10 inches of the Bt horizon. The BE and Bt horizon are loam, silt loam, clay loam, or sandy clay loam in the fine earth.

The Bx horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 3 to 6. It is mottled. It is loam, silt loam, clay loam, or sandy clay loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is mottled in most pedons. It

is loam, sandy loam, silt loam, clay loam, or sandy clay loam in the fine earth.

Canadice Series

The soils of the Canadice series are fine, illitic, mesic Typic Ochraqualfs. They are very deep and poorly drained and are on lowlands and in depressions dominantly in valleys near Muddy Creek, Brush Creek, and Slippery Rock Creek and their tributaries. The soils formed in silts and clays deposited in old glacial lakes. Slope ranges from 0 to 5 percent.

Canadice soils are on the landscape with somewhat poorly drained Caneadea and Gresham soils and poorly drained Atkins, Brinkerton, and Frenchtown soils. The Canadice soils contain more clay throughout the solum than the Atkins, Brinkerton, or Frenchtown soils, and they do not have the fragipan that is characteristic of the Brinkerton and Frenchtown soils.

Typical pedon of Canadice silty clay loam, 2 miles northwest of Unionville, in Moraine State Park, 250 feet south of Legislative Route 10052 (Swamp Run Road) at a point 2,000 feet east of its intersection with Township Route 400 and west of the 90 degree bend in the road:

Ap—0 to 11 inches, very dark grayish brown (10YR 3/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable, slightly sticky, plastic; moderately acid; clear wavy boundary.

Btg1—11 to 18 inches, gray (10YR 5/1) silty clay loam; common medium yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak coarse angular blocky; firm, sticky, plastic; few distinct patches of clay films on faces of peds; strongly acid; gradual wavy boundary.

Btg2—18 to 27 inches, grayish brown (10YR 5/2) silty clay loam; few medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; firm, sticky, plastic; many prominent silt and clay films on faces of prisms and in pores; neutral; gradual wavy boundary.

Btg3—27 to 33 inches, gray (10YR 5/1) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; firm, sticky, plastic; continuous distinct clay films on faces of peds and in pores; neutral; gradual wavy boundary.

Btg4—33 to 42 inches, gray (N 5/0) silty clay; many coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; firm, sticky, plastic; many distinct clay films in pores; neutral; diffuse wavy boundary.

Btg5—42 to 53 inches, gray (N 5/0) silty clay; many coarse prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; firm, sticky, plastic; common distinct clay films in pores and as patches on faces of peds; few black coatings; neutral; diffuse wavy boundary.

BCg—53 to 60 inches, gray (N 5/0) silty clay; many medium distinct yellowish brown (10YR 5/4 and 10YR 5/6) mottles; moderate coarse prismatic structure; firm, sticky, plastic; few distinct clay films on faces of prisms; neutral; diffuse wavy boundary.

Cg—60 to 80 inches, gray (N 5/0) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; firm, sticky, plastic; varved; neutral.

The solum thickness ranges from 30 to 60 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 5 percent throughout the soil. In unlimed areas reaction ranges from slightly acid to very strongly acid in the Ap horizon, from strongly acid to neutral in the upper part of the B horizon, from slightly acid to mildly alkaline in the lower part of the B horizon, and from neutral to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR to 2.5Y, value of 2 to 5, and chroma of 1 to 3.

The B horizon has hue of 5Y to 10YR or is neutral, has value of 4 to 6, and has chroma of 0 to 2. It is mottled. It ranges from silty clay loam to clay and has a range of 35 to 60 percent clay in the particle-size control section.

The C horizon has hue of 10YR to 5Y or is neutral, has value of 4 to 6, and has chroma of 0 to 2. It is mottled. It ranges mainly from silty clay loam to clay. The C horizon has prismatic structure or is massive or varved. In some pedons it is underlain by glacial till or layers of sand.

Caneadea Series

The soils of the Caneadea series are fine, illitic, mesic Aeric Ochraqualfs. They are very deep and somewhat poorly drained and are on lowlands, foot slopes, terraces, and dissected benches in valleys along Slippery Rock Creek and Muddy Creek and their tributaries and in areas along Connoquenessing Creek and Brush Creek. The soils formed in silts and clays deposited in old glacial lakes and in slackwater stream deposits. Slope ranges from 0 to 25 percent.

Caneadea soils are on the landscape with poorly drained Canadice, Brinkerton, Frenchtown, and Atkins soils, somewhat poorly drained Gresham soils, moderately well drained Titusville and Monongahela soils, and well drained Wheeling and Riverhead soils. The Caneadea soils contain more clay than Gresham soils and do not have the fragipan that is characteristic of the Gresham soils.

Typical pedon of Caneadea silt loam, 0 to 3 percent slopes, in an abandoned hayfield in Moraine State Park, 2 miles northwest of Unionville, 760 feet southwest of the old spring house and 430 feet south of the small bridge on the farm lane that runs east from Township Route 400, at a point 800 feet north of the junction of Township Route 400 and Lake Arthur:

Ap—0 to 8 inches, dark grayish brown (10YR 4/2) silt loam; light gray (10YR 7/2) dry; moderate fine granular structure; friable, slightly sticky, slightly plastic; moderately acid; abrupt smooth boundary.

BE—8 to 13 inches, light olive brown (2.5Y 5/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; few faint clay films in pores; very strongly acid; clear wavy boundary.

Bt—13 to 18 inches, yellowish brown (10YR 5/4) silty clay loam; many medium distinct light gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; common distinct light brownish gray (10YR 6/2) silt and clay films on faces of peds; very strongly acid; clear wavy boundary.

Btg1—18 to 24 inches, grayish brown (10YR 5/2) silty clay; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate coarse angular blocky; firm, sticky, plastic; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Btg2—24 to 34 inches, gray (10YR 5/1) silty clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate coarse angular blocky; firm, sticky, plastic; many prominent clay films on faces of peds and in pores; thin sandy layer at 33 inches; strongly acid; diffuse wavy boundary.

Btg3—34 to 44 inches, gray (10YR 5/1) silty clay; many medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm, sticky, plastic; many prominent clay films on faces of peds and in pores; neutral; clear wavy boundary.

Btg4—44 to 51 inches, gray (N 5/0) silty clay loam; few fine prominent yellowish red (5YR 4/6) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm, sticky, plastic; common distinct clay films on faces of peds and in pores; neutral; clear wavy boundary.

Btg5—51 to 60 inches, gray (N 5/0) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; firm, sticky, plastic; common distinct clay films on faces of peds and in pores; neutral.

The solum thickness ranges from 36 to 60 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 5 percent. In unlimed areas reaction ranges from very strongly acid to moderately acid in the upper part of the solum, from slightly acid to neutral in the lower part of the solum, and from neutral to mildly alkaline in the C horizon of pedons that have a C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The BE horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 4. It is mottled. Some pedons do not have a BE horizon.

The upper part of the Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is mottled. The lower part of the Bt horizon has hue of 10YR or 2.5Y or is neutral, has value of 4 or 5, and has chroma of 0 to 4. The B horizon is silty clay, silty clay loam, or clay and has a range of 35 to 60 percent clay in the particle-size control section.

Some pedons have a C horizon that has hue of 10YR to 5Y or is neutral, has value of 4 or 5 and has chroma of 0 to 4. It is mottled. It is mainly silty clay loam or silty clay. The C horizon is typically massive or varved. In some pedons it is glacial till in the lower part.

Cavode Series

The soils of the Cavode series are clayey, mixed, mesic Aeric Ochraquults. They are deep and somewhat poorly drained and are on broad ridgetops, in depressions, and on side slopes throughout the county. The soils formed in residuum of weathered acid gray shale interbedded with siltstone and sandstone. Slope ranges from 0 to 25 percent.

Cavode soils are on the landscape with well drained Gilpin and Hazleton soils, moderately well drained Wharton, Tilsit, and Ernest soils, moderately well drained and somewhat poorly drained Vandergrift soils, and poorly drained Brinkerton soils. The Cavode soils are more acid than and not as red as the Vandergrift soils.

Typical pedon of Cavode silt loam, 3 to 8 percent slopes, in a hay field near Moniteau High School, 2.5 miles south of Annandale and 3.5 miles north of West Sunbury, 840 feet east-southeast of the intersection of State Game Lands access road and Township Route 464 (Brimstone Road) 800 feet east of the intersection of Township Route 464 and PA 308:

Ap—0 to 10 inches, dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; 5 percent rock fragments; moderately acid; abrupt wavy boundary.

Bt—10 to 14 inches, yellowish brown (10YR 5/6) silty clay loam; common fine distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles;

strong medium subangular blocky structure; firm, sticky, plastic; continuous faint clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; abrupt wavy boundary.

Btg1—14 to 18 inches, light brownish gray (10YR 6/2) silty clay; many fine prominent yellowish red (5YR 5/6) and light yellowish brown (10YR 6/4) mottles; strong medium prismatic structure parting to moderate medium and coarse angular blocky; firm, sticky, plastic; many distinct clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; clear wavy boundary.

Btg2—18 to 24 inches, light brownish gray (10YR 6/2) silty clay; light yellowish brown (10YR 6/4) ped faces; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak coarse angular blocky; firm, sticky, plastic; many distinct clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; clear wavy boundary.

Btg3—24 to 34 inches, light brownish gray (10YR 6/2) clay; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate coarse and very coarse prismatic structure; firm, sticky, plastic; many distinct clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; gradual wavy boundary.

Btg4—34 to 45 inches, light brownish gray (10YR 6/2) clay; many medium and coarse yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure; firm, sticky, plastic; many distinct clay films on faces of peds and in pores; 5 percent rock fragments; very strongly acid; abrupt wavy boundary.

C—45 to 60 inches, dark yellowish brown (10YR 4/4) channery silty clay loam; many coarse distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; massive; friable, sticky, plastic; few faint clay films in pores; 20 percent rock fragments; very strongly acid.

The solum ranges from 30 to 60 inches in thickness, and the depth to bedrock ranges from 40 to 72 inches. The content of rock fragments ranges from 0 to 15 percent in the upper part of the solum and from 10 to 80 percent in the BC and C horizons. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The Ap horizon has hue of 10YR, value of 3 or 4 moist and 6 or more dry, and chroma of 2 to 4.

The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is mottled. The lower part of the B horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. It is mottled. The B horizon is silty clay loam, silty clay, or clay in the fine earth.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is mottled. It ranges from silt loam to clay in the fine earth.

Clymer Series

The soils of the Clymer series are fine-loamy, mixed, mesic Typic Hapludults. They are deep and well drained and are on broad ridgetops on dissected uplands throughout all but the extreme northwest corner of the county. The soils formed in residuum of weathered acid sandstone interbedded with siltstone and shale. Slope ranges from 3 to 8 percent.

Clymer soils are on the landscape with well drained Gilpin and Hazleton soils, moderately well drained Cookport, Buchanan, and Wharton soils, somewhat poorly drained Cavode soils, and poorly drained Andover soils. The Clymer soils contain more clay in the solum than the Hazleton soils and are deeper than the Gilpin soils.

Typical pedon of Clymer loam, 3 to 8 percent slopes, in a field in Moraine State Park, 3 miles north of Prospect, 175 feet north of Township Route 366 (Whipperwill Hill Road), at a point of 0.7 mile west of the intersection of Township Route 366 and PA 528:

Ap—0 to 8 inches, very dark grayish brown (10YR 3/2) loam; weak medium and fine granular structure; very friable, slightly sticky, nonplastic; 5 percent rock fragments; slightly acid; abrupt smooth boundary.

BE—8 to 12 inches, dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; 10 percent rock fragments; moderately acid; clear wavy boundary.

Bt1—12 to 17 inches, strong brown (7.5YR 5/6) loam; weak medium angular and subangular blocky structure; friable, slightly sticky, slightly plastic; few faint clay films on some faces of peds; brown (7.5YR 5/4) ped surfaces; 5 percent rock fragments; strongly acid; clear wavy boundary.

Bt2—17 to 22 inches, strong brown (7.5YR 5/6) clay loam; moderate fine angular and subangular blocky structure; friable, slightly sticky, plastic; common distinct clay films on faces of peds and in pores; brown (7.5YR 5/4) and reddish brown (5YR 4/4) ped coatings; 10 percent rock fragments; strongly acid; gradual wavy boundary.

Bt3—22 to 28 inches, strong brown (7.5YR 5/6) clay loam; moderate medium angular blocky structure; friable, slightly sticky, plastic; common distinct clay films on faces of peds and in pores; brown (7.5YR 5/4, 4/4) ped coatings; 10 percent rock fragments; very strongly acid; clear wavy boundary.

Bt4—28 to 38 inches, strong brown (7.5YR 5/6) channery clay loam; moderate medium angular blocky structure; friable, slightly sticky, plastic; common thin distinct clay films on faces of peds, on rock fragments, and in pores; brown (7.5YR 5/4) and yellowish red (5YR 5/6) ped coatings; 30 percent rock fragments; very strongly acid; gradual wavy boundary.

C—38 to 44 inches, strong brown (7.5YR 5/6) extremely channery loam; massive; friable, slightly sticky, slightly plastic; 70 percent rock fragments; very strongly acid; abrupt irregular boundary.
R—44 inches, fractured sandstone.

The solum ranges from 24 to 40 inches in thickness, and the depth to bedrock is 40 inches or more. The content of rock fragments ranges from 0 to 25 percent in the upper part of the solum, from 10 to 35 percent in the lower part of the solum, and from 20 to 85 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid.

The Ap horizon has a hue of 10YR, value of 3 to 5, and chroma of 2 to 4. In uncultivated areas, the A horizon is very dark brown to black and is 1 to 3 inches thick. The E horizon is gray to yellowish brown and is 3 to 6 inches thick.

The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. It is sandy loam, loam, or clay loam in the fine earth.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. In some pedons the C horizon is faintly mottled below a depth of 40 inches. The C horizon dominantly is sandy loam or loam in the fine earth.

Cookport Series

The soils of the Cookport series are fine-loamy, mixed, mesic Aquic Fragiudults. They are deep and moderately well drained and are on broad ridgetops and side slopes on dissected uplands throughout all but the northwest corner of the county. The soils formed in residuum of weathered acid gray and brown sandstone interbedded with siltstone and shale. Slope ranges from 0 to 25 percent.

Cookport soils are on the landscape with well drained Clymer and Hazleton soils, moderately well drained Buchanan soils, and poorly drained Andover soils. The Cookport soils have a thinner solum than the Buchanan soils.

Typical pedon of Cookport loam, 3 to 8 percent slopes, in cropland 1 mile southwest of Unionville, on the north side of Township Route 443, 500 feet west of the intersection of Township Route 443 and Legislative Route 10053:

Ap—0 to 7 inches, dark brown (10YR 3/3) loam; weak fine granular structure; very friable, nonsticky, nonplastic; 2 percent rock fragments; slightly acid; abrupt smooth boundary.
EB—7 to 9 inches, yellowish brown (10YR 5/4) loam; moderate very fine subangular blocky structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; strongly acid; abrupt smooth boundary.
BE—9 to 15 inches, yellowish brown (10YR 5/4) loam; weak medium platy and moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; very strongly acid; clear wavy boundary.
Bt—15 to 24 inches, yellowish brown (10YR 5/4) loam; common medium prominent light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; common distinct clay films on faces of peds and in pores; very strongly acid; abrupt wavy boundary.
Btx1—24 to 29 inches, strong brown (7.5YR 5/6) loam; many medium prominent gray (10YR 6/1), yellowish brown (10YR 5/6), and yellowish red (5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium platy and weak medium and fine subangular blocky; very firm, brittle, slightly sticky, slightly plastic; 2 percent rock fragments; common distinct clay films mainly on horizontal faces of peds and filling pores; very strongly acid; clear wavy boundary.
Btx2—29 to 39 inches, dark yellowish brown (10YR 4/4) channery sandy loam; common coarse prominent gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak thick platy; very firm, somewhat brittle, nonsticky, slightly plastic; 25 percent rock fragments; common distinct clay films on faces of peds and in pores; very strongly acid; clear wavy boundary.
C1—39 to 44 inches, brown (7.5YR 5/4) channery sandy loam; many coarse prominent gray (10YR 6/1), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/4) mottles; weak very thick platy structure; very firm, nonsticky, slightly plastic; 25 percent rock fragments; very strongly acid; clear wavy boundary.
C2—44 to 52 inches, brown (7.5YR 5/4) extremely channery loamy sand; common medium and coarse distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; weak very thick platy structure; firm, nonsticky, nonplastic; 70 percent rock fragments; few faint patches of clay on rock fragments and clay bridges between sand grains; very strongly acid; abrupt wavy boundary.
C3—52 to 60 inches, strong brown (7.5YR 5/6) very channery loamy sand; massive; very firm, slightly sticky, slightly plastic; 45 percent rock fragments; very strongly acid.

The solum ranges from 28 to 40 inches in thickness. The depth to the fragipan ranges from 16 to 27 inches, and the depth to bedrock ranges from 40 to 72 inches. The content of rock fragments ranges from 0 to 30 percent throughout the solum and from 0 to 80 percent in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid throughout the profile.

The Ap horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 3 to 6. It ranges from silt loam to sandy loam.

The E horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 or 4. It ranges from silt loam to sandy loam.

The BE, Bt, and Bx horizons have hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8. They are sandy loam, loam, sandy clay loam, or clay loam in the fine earth. Mottling begins in the upper 10 inches of the argillic horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. It ranges from loamy sand to loam in the fine earth.

Ernest Series

The soils of the Ernest series are fine-loamy, mixed, mesic Aquic Fragiudults. They are very deep and moderately well drained and are on foot slopes, benches, and lowlands throughout all but the extreme northwest corner of the county. The soils formed in colluvium from shale, siltstone, and some sandstone. Slope ranges from 3 to 15 percent.

Ernest soils are on the landscape with well drained Gilpin, Weikert, and Hazleton soils, moderately well drained Wharton and Tilsit soils, somewhat poorly drained Cavode soils, and poorly drained Brinkerton and Atkins soils. The Ernest soils have a thicker solum than the Wharton soils, and the Wharton soils do not have a fragipan. The Ernest soils contain less silt above the fragipan than the Tilsit soils.

Typical pedon of Ernest silt loam, 8 to 15 percent slopes, in a cultivated area 1.5 miles northwest of Mount Chestnut, on the north side of Township Route 441, 336 feet east of its intersection with Township Route 439:

Ap—0 to 8 inches dark grayish brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) dry; weak fine granular structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; moderately acid; abrupt smooth boundary.

BE—8 to 12 inches, pale brown (10YR 6/3) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium platy structure readily parting to moderate very fine subangular blocky; friable, slightly sticky, slightly plastic; 1 percent rock fragments; strongly acid; clear wavy boundary.

Bt1—12 to 15 inches, pale brown (10YR 6/3) silt loam; many fine distinct yellowish brown (10YR 5/4 and 10YR 5/6) mottles and common fine distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak thick platy structure parting to moderate medium platy; friable, sticky, plastic; 1 percent rock fragments; few faint clay films on faces of peds and in pores; very strongly acid; clear wavy boundary.

Bt2—15 to 23 inches, pale brown (10YR 6/3) silt loam; many fine distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2 and 2.5Y 6/2) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm, slightly sticky, plastic; 10 percent rock fragments; common distinct clay films on faces of peds and in pores; strongly acid; clear wavy boundary.

Btx1—23 to 38 inches, yellowish brown (10YR 5/4) channery silty clay loam; many medium and fine prominent gray (10YR 6/1 and 5Y 6/1) and brown (10YR 5/3 and 7.5YR 5/4) mottles; moderate coarse prismatic structure parting to moderate very thick platy and moderate medium subangular blocky; very firm, brittle, slightly sticky, plastic; continuous distinct clay films on some faces of peds and in pores; gray (10YR 6/1) coatings on prisms; few fine black concretions; 25 percent rock fragments; strongly acid; gradual wavy boundary.

Btx2—38 to 55 inches, yellowish brown (10YR 5/4) channery silt loam; common medium and fine distinct yellowish brown (10YR 5/6), brown (10YR 5/3), and gray (10YR 6/1) mottles; moderate coarse prismatic structure parting to weak very thick platy and coarse subangular blocky; very firm, brittle, slightly sticky, plastic; common distinct clay films on faces of peds; gray (10YR 6/1) coatings on prisms and some peds; 25 percent rock fragments; strongly acid; gradual wavy boundary.

C—55 to 60 inches, brown (10YR 5/3) channery silt loam; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; moderate coarse prismatic structure; very firm, slightly sticky, slightly plastic; light brownish gray (2.5Y 6/2) coatings on prisms; 30 percent rock fragments; strongly acid.

The solum ranges from 36 to 72 inches in thickness. The depth to the fragipan ranges from 20 to 36 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 20 percent above the fragipan and from 5 to 40 percent in the fragipan and the C horizon. In unlimed areas reaction is strongly acid or very strongly acid throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The BE and Bt horizons have hue of 10YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. The Bt horizon is mottled. The BE and Bt horizons are silt loam or silty clay loam in the fine earth.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is mottled. It is silt loam, silty clay loam, loam, or clay loam in the fine earth.

The C horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is mottled. It ranges from loam to silty clay loam in the fine earth.

Fluvaquents

Fluvaquents consist of deep, poorly drained and very poorly drained soils on a few flood plains in the northern half of the county. The soils formed in alluvium from acid sandstone, siltstone, and shale. Recent local alluvium containing coal and other rock fragments has been deposited on the surface. Slope ranges from 0 to 3 percent.

Fluvaquents are on flood plains with poorly drained Atkins soils and are near moderately well drained Wharton, Ernest, and Buchanan soils, somewhat poorly drained Cavode soils, and poorly drained Brinkerton and Andover soils.

Because of variability of Fluvaquents, a typical pedon is not given. The solum thickness ranges from 20 to 40 inches, and the depth to bedrock is 40 inches or more. Coal and other rock fragments make up 0 to 50 percent of the A horizon. There commonly are no rock fragments in the C horizon, but their content ranges to as much as 35 percent. The A horizon is dominantly extremely acid, and the C horizon ranges from strongly acid to extremely acid.

The A horizon has hue of 2.5YR to 5Y or is neutral, has value of 2 to 6, and has chroma of 0 to 6. It generally is mottled. It ranges from sandy loam to silty clay loam in the fine earth. The A horizon is 6 to 24 inches thick.

The C horizon has hue of 10YR to 5Y or is neutral, has value of 4 to 6, and has chroma of 0 to 6. It is mottled. It is stratified and ranges from loamy sand to silty clay loam in the fine earth.

Fredon Series

The soils of the Fredon series are coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Aeric Haplaquepts. They are very deep and somewhat poorly drained and poorly drained and are on outwash plains, in depressions on benches, and on terraces in the northwest part of the county. The soils formed in glacial outwash consisting primarily of stratified sand and gravel. Slope ranges from 0 to 8 percent.

The Fredon soils are on the landscape with well drained Wheeling and Riverhead soils, moderately well drained Braceville soils, and poorly drained Frenchtown soils. The Fredon soils do not have the fragipan that is characteristic of the Frenchtown soils.

Typical pedon of Fredon loam, 0 to 3 percent slopes, in a field in Moraine State Park, 1 mile west of Muddy Creek, 0.7 mile west and 460 feet north of the intersection of Township Routes 404 and 414:

Ap—0 to 8 inches, very dark grayish brown (10YR 3/2) loam; common fine distinct brown (10YR 4/3) and dark grayish brown (10YR 4/2) mottles; weak fine granular structure; friable, slightly sticky, nonplastic; 2 percent rock fragments; moderately acid; abrupt smooth boundary.

EB—8 to 10 inches, dark grayish brown (10YR 4/2) loam; common medium distinct very dark grayish brown (10YR 3/2), yellowish brown (10YR 5/6), and gray (10YR 6/1) mottles; weak fine subangular blocky structure parting to weak medium granular; friable, slightly sticky, slightly plastic; 2 percent rock fragments; moderately acid; clear smooth boundary.

Bw—10 to 14 inches, light olive brown (2.5Y 5/4) loam; many medium prominent yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; 2 percent rock fragments; moderately acid; clear smooth boundary.

Bg—14 to 21 inches, grayish brown (2.5Y 5/2) loam; many medium prominent yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; 2 percent rock fragments; moderately acid; clear wavy boundary.

Bcg—21 to 30 inches, grayish brown (2.5Y 5/2) sandy loam; many coarse prominent yellowish brown (10YR 5/4 and 10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable, slightly sticky, nonplastic; 2 percent rock fragments; moderately acid; gradual wavy boundary.

C1—30 to 46 inches, brown (7.5YR 5/4) loamy sand; many coarse prominent grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4 and 10YR 5/6) mottles; single grain; loose, nonsticky, nonplastic; 5 percent rock fragments; slightly acid.

C2—46 to 60 inches, yellowish brown (10YR 5/4) stratified gravel and sand; common coarse prominent grayish brown (2.5Y 5/2) mottles; single grain; loose, nonsticky, nonplastic; neutral.

The solum ranges from 22 to 40 inches in thickness, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 35 percent in the A, E, and B horizons, and from 0 to 60 percent in the BC and C horizons. Reaction ranges from moderately acid to neutral in the solum, and from slightly acid to mildly alkaline in the substratum.

The Ap horizon has hue of 10YR to 2.5Y, value of 2 to 4, and chroma of 1 or 2.

The B horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is mottled. The B horizon ranges from fine sandy loam to silt loam in the fine earth. The BC horizon ranges from sandy loam to silt loam.

The C horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is mottled in most pedons. It is stratified and ranges from loamy fine sand to sand in the fine earth.

Frenchtown Series

The soils of the Frenchtown series are fine-loamy, mixed, mesic Typic Fragiaqualfs. They are very deep and poorly drained and are on smooth or undulating till plains, on benches, and in minor drainageways in the northwest part of the county. The soils formed in glacial till. Slope ranges from 0 to 8 percent.

Frenchtown soils are on the landscape with well drained Wheeling and Riverhead soils, moderately well drained Titusville and Braceville soils, somewhat poorly drained Gresham soils, somewhat poorly drained and poorly drained Fredon soils, and poorly drained Atkins soils. The Frenchtown soils have a fragipan, but the Fredon and Atkins soils do not.

Typical pedon of Frenchtown silt loam, 3 to 8 percent slopes, 0.5 mile southwest of Slippery Rock Borough, 100 feet south of the maintenance building and 110 feet west of Township Route 372:

Ap1—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; few fine faint grayish brown (2.5Y 5/2) mottles; weak fine and medium granular structure; friable, slightly sticky, nonplastic; 2 percent rock fragments; moderately acid; abrupt smooth boundary.

Ap2—9 to 12 inches, dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam; weak fine platy structure parting to moderate medium and fine granular; friable, slightly sticky, slightly plastic; 1 percent rock fragments; moderately acid; clear smooth boundary.

Btg—12 to 17 inches, grayish brown (2.5Y 5/2) silt loam; many fine and medium distinct light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and light olive brown (2.5Y 5/4) mottles; moderate medium and fine subangular blocky structure; firm, slightly sticky, plastic; common faint clay films on faces of peds and lining pores; 1 percent rock fragments; moderately acid; clear wavy boundary.

Btxg1—17 to 30 inches, grayish brown (2.5Y 5/2) silt loam; common medium distinct light olive brown (2.5Y 5/4), yellowish brown (10YR 5/4), and gray (10YR 6/1) mottles; weak coarse prismatic structure parting to moderate thick and medium platy and angular blocky; very firm, brittle, slightly sticky, slightly plastic; common faint clay films on faces of peds and in pores; thick gray (10YR 5/1) prism coatings; moderately acid; gradual wavy boundary.

Btxg2— 30 to 50 inches, olive brown (2.5Y 4/4) loam; many medium prominent light gray (10YR 6/1, 5Y 6/1), light brownish gray (2.5Y 6/2), and yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure parting to moderate thick platy and moderate medium angular blocky; very firm, brittle, slightly sticky, slightly plastic; common distinct clay films on faces of peds, on rock fragments, and lining pores; thick gray (5Y 5/1) and grayish brown (2.5Y 5/2) prism coatings; 5 percent rock fragments increasing to 10 percent in lower part; moderately acid; gradual wavy boundary.

Bx3—50 to 65 inches, olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) gravelly loam; common coarse to fine distinct gray (10YR 5/1, 6/1), brown (10YR 5/3), and yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure parting to weak thick platy in the upper part; very firm, somewhat brittle, nonsticky, nonplastic; grayish brown (2.5Y 5/2) prism coatings; 25 percent rock fragments; moderately acid.

The solum thickness ranges from 40 to 80 inches, and the depth to bedrock is more than 60 inches. The depth to the fragipan ranges from 16 to 32 inches. The content of rock fragments ranges from 0 to 10 percent in the upper part of the solum and from 2 to 30 percent in the lower part of the solum and in the C horizon. In unlimed areas reaction ranges from moderately acid to very strongly acid in the upper part of the solum, from slightly acid to strongly acid in the lower part of the solum, and from moderately acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

The Bt horizon is neutral or has hue of 10YR to 5Y, has value of 4 to 6, and has chroma of 0 to 2 on ped surfaces and in ped interiors. It is mottled. It is clay loam, loam, silty clay loam, or silt loam.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is mottled. Prism surfaces have hue of 10YR to 5Y or are neutral, have value of 4 to 6, and have chroma of 0 to 2. The Bx horizon is loam, silt loam, or clay loam in the fine earth.

Some pedons have a C horizon that has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is mottled. It is loam, silt loam, or clay loam in the fine earth.

Gilpin Series

The soils of the Gilpin series are fine-loamy, mixed, mesic Typic Hapludults. They are moderately deep and well drained and are on broad ridgetops, side slopes, and hillsides on dissected uplands throughout the county. The soils formed in residuum weathered from acid, gray and brown interbedded siltstone, shale, and sandstone. Slope ranges from 3 to 70 percent.

Gilpin soils are on the landscape with well drained Weikert, Hazleton, and Clymer soils; moderately well drained Wharton, Tilsit, and Ernest soils; somewhat poorly drained Cavode soils; and poorly drained Brinkerton soils.

Typical pedon of Gilpin silt loam, 8 to 15 percent slopes, in a field 3 miles northwest of Prospect, 2.5 miles east of Portersville, on the north side of Township Route 344, 3,000 feet southeast of its intersection with

Legislative Route 10050 and 0.75 mile northwest of its intersection with Township Route 361:

Ap—0 to 8 inches, dark grayish brown (10YR 4/2) silt loam; weak very fine granular structure; very friable, slightly sticky, nonplastic; 10 percent rock fragments; moderately acid; abrupt wavy boundary.
BE—8 to 15 inches, yellowish brown (10YR 5/4) channery silt loam; weak medium platy structure parting to weak fine subangular blocky; friable, slightly sticky, nonplastic; 15 percent rock fragments; strongly acid; clear wavy boundary.
Bt—15 to 21 inches, yellowish brown (10YR 5/4) channery silty clay loam; weak fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; common distinct clay films on faces of peds and rock fragments and in pores; 20 percent rock fragments; very strongly acid; clear wavy boundary.
BCt—21 to 30 inches, yellowish brown (10YR 5/4) very channery silty clay loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few distinct clay films on faces of peds and rock fragments; 35 percent rock fragments; extremely acid; gradual wavy boundary.
C—30 to 36 inches, yellowish brown (10YR 5/4) and brown (10YR 4/3) extremely channery silt loam; weak thick platy structure; slightly firm, slightly sticky, nonplastic; black coatings and few distinct clay films on rock fragments; 65 percent rock fragments; very strongly acid; clear wavy boundary.
R—36 inches, fractured light olive brown (2.5Y 5/4) siltstone; very strongly acid.

The solum ranges from 20 to 36 inches in thickness, and the depth to bedrock is 20 to 40 inches. The content of rock fragments ranges from 5 to 40 percent in individual horizons of the solum and 30 to 90 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR to 2.5Y, value of 5, and chroma of 4 to 6. It ranges from silt loam or loam to silty clay loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silt loam or loam in the fine earth.

Gresham Series

The soils of Gresham series are fine-loamy, mixed, mesic Aeric Fragiaqualfs. They are very deep and somewhat poorly drained and are on till plains and moraines in the northwest part of the county. The soils formed in glacial till derived mostly from shale, siltstone, and sandstone. Slope ranges from 0 to 15 percent.

The Gresham soils are on the landscape with well drained Wheeling and Riverhead soils, moderately well drained Titusville soils, and poorly drained Frenchtown soils.

Typical pedon of Gresham silt loam, 0 to 3 percent slopes, in a hay field 1.25 miles east of Harrisville, 570 feet north-northeast of PA 58, across from utility pole no. 15 and 306 feet south of the northwest corner of the field:

Ap—0 to 8 inches, dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; neutral; abrupt smooth boundary.
Bt—8 to 14 inches, yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) silt loam; common fine faint light gray (10YR 7/2) mottles; weak thin platy structure; friable, slightly sticky, slightly plastic; common faint clay films on faces of peds, common distinct clay films in pores; 1 percent rock fragments; very strongly acid; clear wavy boundary.
Btg—14 to 21 inches, grayish brown (10YR 5/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to weak fine subangular blocky; friable, slightly sticky, slightly plastic; continuous distinct clay films on faces of smaller peds, continuous prominent clay films on prisms and in pores; light gray (10YR 7/1) prism coatings; 3 percent rock fragments; very strongly acid; clear wavy boundary.
Btx1—21 to 30 inches, brown (7.5YR 4/4) silt loam; few fine distinct yellowish red (5YR 5/8) mottles and common fine distinct gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to weak thick platy; firm and brittle, slightly sticky, slightly plastic; common distinct clay films on faces of smaller peds, continuous prominent clay films on prisms and in pores; light gray (10YR 7/1) prism coatings; common black coatings; 2 percent rock fragments; very strongly acid; diffuse wavy boundary.
Btx2—30 to 39 inches, brown (7.5YR 4/4) silt loam; few medium faint pinkish gray (7.5YR 7/2) mottles; moderate very coarse prismatic structure; firm and brittle; slightly sticky, slightly plastic; many prominent clay films on prisms and in pores; gray (10YR 7/1) prism coatings; thick black coatings; 8 percent rock fragments; very strongly acid; clear wavy boundary.
Btx3—39 to 52 inches, strong brown (7.5YR 5/6) silt loam; common medium distinct very pale brown (10YR 7/3) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; firm and brittle, slightly sticky, slightly plastic; common distinct clay films on faces of smaller peds, many prominent clay films on prisms and in pores;

light gray (N 7/0) common black prism coatings; 10 percent rock fragments; strongly acid; diffuse wavy boundary.

Btx4—52 to 67 inches, strong brown (7.5YR 5/6) silt loam; few fine distinct light gray (10YR 7/1) mottles; moderate very coarse prismatic structure parting to weak fine subangular blocky; firm and brittle, slightly sticky, slightly plastic; common distinct clay films on faces of peds and in pores; light gray (N 7/0) prism coatings; many black coatings and concretions; 10 percent rock fragments; strongly acid; diffuse wavy boundary.

Btx5—67 to 75 inches, yellowish brown (10YR 5/6) gravelly loam; few fine distinct light gray (10YR 7/1) mottles; very weak coarse prismatic structure parting to strong medium subangular blocky; firm, slightly sticky, slightly plastic; common distinct clay films on faces of peds and in pores; gray (N 7/0) prism coatings; common black coatings; 20 percent rock fragments; strongly acid.

The solum is 60 inches thick or more. The depth to the fragipan ranges from 15 to 26 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 5 percent in the upper part of the solum, and from 5 to 35 percent in the lower part and in the C horizon. In unlimed areas reaction ranges from extremely acid to strongly acid above a depth of 40 inches, is strongly acid or moderately acid between depths of 40 and 60 inches, and is neutral or mildly alkaline at a depth of more than 60 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is mottled. It is silt loam, silty clay loam, loam, or clay loam in the fine earth.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is mottled. It is silt loam, silty clay loam, clay loam, or loam in the fine earth. Ped coatings have chroma of 2 or less.

Some pedons have a C horizon that has hue of 7.5YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is mottled. It is dominantly loam or clay loam in the fine earth.

Hazleton Series

The soils of the Hazleton series are loamy-skeletal, mixed, mesic Typic Dystrochrepts. They are deep and well drained and are on ridges and hillsides throughout the county. The soils formed in residuum of weathered acid gray and brown sandstone interbedded with siltstone and shale. Slope ranges from 0 to 70 percent.

The Hazleton soils are on the landscape with moderately deep Gilpin soils, deep Clymer soils, and shallow Weikert soils; moderately well drained Cookport and Buchanan soils; and poorly drained Andover soils. The Hazleton soils contain less clay in the upper part of the solum than the Clymer soils.

Typical pedon of Hazleton channery loam, 8 to 15 percent slopes, in a cultivated field 1 mile southwest of Unionville and 3 miles north of Mount Chestnut, on the north side of Township Route 443 near the Franklin and Center Townships line, 1,400 feet west of the intersection of Township Route 443 and Legislative Route 10063:

Ap—0 to 7 inches, dark grayish brown (10YR 4/2) channery loam; moderate medium and fine granular structure; very friable, slightly sticky, slightly plastic; 20 percent rock fragments; slightly acid; abrupt smooth boundary.

BE—7 to 9 inches, yellowish brown (10YR 5/6) channery loam; weak fine subangular blocky structure with tendency to be platy; friable, slightly sticky, slightly plastic; 15 percent rock fragments; slightly acid; abrupt wavy boundary.

Bw1—9 to 14 inches, strong brown (7.5YR 5/6) channery loam; moderate to weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; 15 percent rock fragments; strongly acid; clear wavy boundary.

Bw2—14 to 19 inches, strong brown (7.5YR 5/6) channery loam; moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; 15 percent rock fragments; few faint clay bridges between sand grains; very strongly acid; clear wavy boundary.

Bw3—19 to 26 inches, strong brown (7.5YR 5/6) channery sandy loam; weak coarse subangular blocky structure readily parting to moderate medium subangular blocky; friable, slightly sticky, slightly plastic; 30 percent rock fragments; very few faint clay bridges between sand grains; very strongly acid; clear wavy boundary.

BC—26 to 34 inches, strong brown (7.5YR 5/6) very channery sandy loam; weak coarse and medium subangular blocky structure; friable, nonsticky, nonplastic; 50 percent rock fragments; very few faint clay bridges between sand grains; extremely acid; clear wavy boundary.

C1—34 to 44 inches, strong brown (7.5YR 5/6), yellowish brown (10YR 5/4 and 10YR 5/6), and light yellowish brown (2.5Y 6/4) very channery loamy sand and sandy loam; weak coarse subangular blocky structure; firm, nonsticky, nonplastic; 50 percent rock fragments; extremely acid; gradual wavy boundary.

C2—44 to 54 inches, yellowish brown (10YR 5/6) very channery sandy loam with few thin strata of light brownish gray (10YR 6/2) loamy sand; massive; firm, nonsticky, nonplastic; 35 percent rock fragments; extremely acid; gradual wavy boundary.

C3—54 to 84 inches, yellowish brown (10YR 5/4) very channery loamy sand; common coarse distinct strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and light yellowish brown (2.5Y 6/4) mottles or patches; massive at the top, becoming single grain; friable to very friable, nonsticky, nonplastic; 50 percent rock fragments; extremely acid; abrupt wavy boundary.
R—84 inches, fractured brown (10YR 4/3) sandstone.

The solum ranges from 25 to 50 inches in thickness, and the depth to bedrock is 40 inches or more. The content of rock fragments ranges from 5 to 70 percent in individual horizons in the solum and from 36 to 80 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In uncultivated areas the A horizon is 1 or 2 inches thick and has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4.

The B horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 3 to 8. It is loam or sandy loam in the fine earth. The BC horizon ranges from loam to loamy sand in the fine earth.

The C horizon has hue of 5YR to 2.5Y, value of 3 to 6, and chroma of 2 to 6. It ranges from loam to loamy sand in the fine earth.

Monongahela Series

The soils of the Monongahela series are fine-loamy, mixed, mesic Typic Fragiudults. They are very deep and moderately well drained and are on terraces mainly along Connoquenessing and Brush Creeks. The soils formed in old alluvium dominantly from shale, siltstone, and sandstone. Slope ranges from 3 to 15 percent.

Monongahela soils are on the landscape with well drained Pope and Wheeling soils, moderately well drained Ernest and Philo soils, somewhat poorly drained Caneadea soils, and poorly drained Atkins, Brinkerton, and Canadice soils. The Ernest soils have low-chroma mottles in the upper 10 inches of the argillic horizon. The Philo soils do not have a fragipan and are on flood plains.

Typical pedon of Monongahela silt loam, 3 to 8 percent slopes, in grassland in Zelienople, on the south side of PA 68, 75 feet east of the intersection of Township Route 752 and PA 68:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable, slightly sticky, slightly plastic; 10 percent rock fragments; strongly acid; abrupt smooth boundary.
Bt—9 to 20 inches, yellowish brown (10YR 5/4) silt loam; moderate medium angular and subangular blocky structure; firm, sticky, plastic; common distinct clay films on faces of peds and in pores; 10 percent rock fragments; very strongly acid; clear wavy boundary.
Btx1—20 to 29 inches, brown (10YR 4/3) gravelly silt loam; many medium prominent light brownish gray (2.5Y 6/2) and brown (7.5YR 5/4) mottles; moderate coarse prismatic structure parting to weak thick platy and moderate medium subangular blocky; very firm and brittle, sticky, plastic; common distinct clay films on faces of peds; common black coatings; 15 percent rock fragments; very strongly acid; gradual wavy boundary.
2Btx2—29 to 40 inches, brown (7.5YR 4/4) gravelly sandy clay loam; many medium prominent light olive gray (5Y 6/2) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium platy; very firm and brittle, slightly sticky, slightly plastic; common distinct clay films on faces of peds; few black coatings; 25 percent rock fragments; very strongly acid; gradual wavy boundary.
2C—40 to 60 inches, brown (7.5YR 4/4) gravelly sandy loam; many medium prominent light gray (5Y 7/2) and strong brown (7.5YR 5/6) mottles; massive with tendency toward very weak medium platy structure; firm, slightly sticky, slightly plastic; 25 percent rock fragments; very strongly acid.

The solum ranges from 40 to 72 inches in thickness. The depth to the fragipan ranges from 18 to 30 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 15 percent in horizons above the fragipan, from 0 to 25 percent in the fragipan, and from 10 to 40 percent in the C horizon. In unlimed areas the soil is very strongly acid or strongly acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. Low-chroma mottles are below the upper 10 inches of the argillic horizon. The Bt horizon is silt loam, loam, silty clay loam, clay loam, or sandy clay loam.

The Btx horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is mottled. It ranges from silt loam to sandy clay loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 2 to 8. It is commonly mottled. It ranges from sandy loam to silty clay loam in the fine earth.

Philo Series

The soils of the Philo series are coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts. They are deep and moderately well drained and are on flood plains along the major waterways. The soils formed in alluvium from

sandstone, shale, and siltstone. Slope ranges from 0 to 3 percent.

The Philo soils are on flood plains with well drained Pope soils and poorly drained Atkins soils.

Typical pedon of Philo loam, in the Little Con Boy Scout Camp in Connoquenessing Township, near the confluence of the Little Connoquenessing Creek and Mulligan Run, 120 feet south of the stone bridge on Township Route 431:

Ap—0 to 10 inches, dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; dark yellowish brown (10YR 4/4) lenses; moderate medium and fine granular structure; friable, slightly sticky, nonplastic; strongly acid; abrupt wavy boundary.

Bw1—10 to 20 inches, dark yellowish brown (10YR 4/4) sandy loam; yellowish brown (10YR 5/4) lenses and thin strata; weak medium and fine subangular blocky structure; very friable, nonsticky, nonplastic; strongly acid; abrupt wavy boundary.

Bw2—20 to 26 inches, dark yellowish brown (10YR 4/4) sandy loam; common medium distinct grayish brown (10YR 5/2), dark brown (7.5YR 4/4), and strong brown (7.5YR 5/6) mottles and lenses; very weak thick platy structure parting to weak fine subangular blocky; friable, nonsticky, nonplastic; moderately acid; gradual wavy boundary.

Bw3—26 to 36 inches, dark yellowish brown (10YR 4/4) sandy loam; many coarse prominent brown (10YR 4/3), grayish brown (10YR 5/2), and very dark brown (10YR 2/2) mottles and lenses; very weak thick platy structure parting to weak fine subangular blocky, becoming single grain in the lower part; friable in the upper part and loose in the lower part, nonsticky, nonplastic; moderately acid; gradual wavy boundary.

C1—36 to 46 inches, grayish brown (10YR 5/2) sandy loam; many coarse prominent brown (10YR 4/3), gray (10YR 6/1), and yellowish red (5YR 4/6) mottles and strata; massive; friable, nonsticky, nonplastic; moderately acid; abrupt wavy boundary.

C2—46 to 60 inches, yellowish brown (10YR 5/4) stratified gravelly sand, loamy sand, and gravelly loamy sand; reddish brown (5YR 5/4) and grayish brown (10YR 5/2) streaks and lenses; single grain; loose, nonsticky, nonplastic; 35 percent rock fragments; strongly acid.

The solum thickness ranges from 20 to 48 inches, and the depth to bedrock is 40 inches or more. The content of rock fragments ranges from 0 to 20 percent in the particle-size control section. In unlimed areas reaction ranges from very strongly acid to moderately acid throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The depth to low-chroma mottles ranges from 12 to 24 inches. The B horizon ranges from silt loam to sandy loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y or is neutral, has value of 4 to 6, and has chroma of 0 to 4. It is mottled. It ranges from silt loam to sandy loam in the fine earth. The depth to stratified sand and gravel ranges from 30 to 60 inches.

Pope Series

The soils of the Pope series are coarse-loamy, mixed, mesic Fluventic Dystrochrepts. They are very deep and well drained and are on flood plains dominantly along the Connoquenessing Creek and its larger tributaries. The soils formed in alluvium from sandstone, shale, and siltstone. Slope ranges from 0 to 3 percent.

Pope soils are on flood plains with moderately well drained Philo soils and poorly drained Atkins soils.

Typical pedon of Pope loam, in the Little Con Boy Scout Camp in Connoquenessing Township, along the Little Connoquenessing Creek, 250 feet north of Township Route 431:

Ap—0 to 7 inches, dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable, slightly sticky, nonplastic; moderately acid; abrupt smooth boundary.

Bw1—7 to 10 inches, brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable, slightly sticky, nonplastic; strongly acid; clear smooth boundary.

Bw2—10 to 24 inches, brown (7.5YR 4/4) fine sandy loam; weak medium and fine subangular blocky structure; friable, slightly sticky, slightly plastic; strongly acid; clear wavy boundary.

Bw3—24 to 40 inches, brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable, slightly sticky, nonplastic; strongly acid; clear wavy boundary.

BC—40 to 45 inches, yellowish brown (10YR 5/4) loam; thin lenses of fine sandy loam; weak medium and fine subangular blocky structure; friable, slightly sticky, nonplastic; strongly acid; clear wavy boundary.

C1—45 to 57 inches, yellowish brown (10YR 5/6) sandy loam; massive; friable, nonsticky, nonplastic; strongly acid; abrupt wavy boundary.

C2—57 to 80 inches, brown (10YR 5/3) stratified very gravelly loamy sand and loamy sand; single grain; loose, nonsticky, nonplastic; 60 percent rock fragments in strata; strongly acid.

The solum thickness ranges from 30 to 50 inches, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 30 percent to a depth of less than 40 inches and from 0 to 60 percent at a depth of more than 40 inches. In unlimed

areas reaction ranges from extremely acid to strongly acid throughout the profile.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Some pedons have low-chroma mottling at a depth of more than 30 inches. The B horizon ranges from sandy loam to silt loam in the fine earth.

The C horizon has hue of 10YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. In the fine earth it is loamy sand, sandy loam, loam, or sandy clay loam or stratified layers of any of those textures.

Riverhead Series

The soils of the Riverhead series are coarse-loamy, mixed, mesic Typic Dystrochrepts. They are very deep and well drained and are on outwash plains, kames, eskers, and terraces on glaciated uplands dominantly in the northwest part of the county. The soils formed in sandy glacial outwash. Slope ranges from 3 to 30 percent.

Riverhead soils are on the landscape with well drained Wheeling soils, moderately well drained Braceville soils, somewhat poorly drained and poorly drained Fredon soils, and poorly drained Frenchtown soils. The Riverhead soils contain more sand and less clay in the upper part of the solum than the Wheeling soils.

Typical pedon of Riverhead sandy loam, 3 to 8 percent slopes, in a hay field in Moraine State Park, 3 miles north-northeast of Portersville, 600 feet east of the gas line pressure regulating station on the east side of Legislative Route 10048, 200 feet south of the abandoned ramp from I-79:

Ap—0 to 10 inches, dark brown (10YR 3/3) sandy loam; weak medium granular structure; friable, nonsticky, nonplastic; 5 percent rock fragments; slightly acid; abrupt smooth boundary.

Bw—10 to 20 inches, brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable, nonsticky, nonplastic; very few faint clay bridges between sand grains; 2 percent rock fragments; slightly acid; clear wavy boundary.

BC—20 to 27 inches, brown (7.5YR 4/4) coarse sandy loam; weak medium subangular blocky structure; friable, nonsticky, nonplastic; very few faint clay bridges between sand grains; 5 percent rock fragments; moderately acid; clear smooth boundary.

C1—27 to 30 inches, brown (7.5YR 5/4) gravelly loamy sand; massive; very friable, nonsticky, nonplastic; very few faint clay bridges between sand grains; 20 percent rock fragments; 3/4 inch lenses of gravelly sandy loam with few faint clay bridges between sand grains; strongly acid; abrupt smooth boundary.

C2—30 to 46 inches, pale brown (10YR 6/3) and brown (10YR 5/3) loamy sand; massive; very friable, nonsticky, nonplastic; three lenses of brown (7.5YR 4/4) sandy loam 0.5 to 1.25 inches thick; 2 percent rock fragments; strongly acid; abrupt smooth boundary.

C3—46 to 58 inches, pale brown (10YR 6/3) loamy sand; massive; very friable, nonsticky, nonplastic; six lenses of brown (7.5YR 4/4) sandy loam 0.25 to 0.5 inch thick; 1 percent rock fragments; strongly acid; abrupt wavy boundary.

C4—58 to 60 inches, brown (10YR 5/3) gravelly loamy sand; multicolored sand grains; massive; very friable; nonsticky and nonplastic; 30 percent rock fragments; strongly acid.

The solum ranges from 24 to 36 inches in thickness, and the depth to bedrock is more than 60 inches. The content of rock fragments ranges from 2 to 35 percent in the 10- to 40-inch particle-size control section. In unlimed areas reaction is very strongly acid or strongly acid in the solum and ranges from very strongly acid to neutral in the C horizon below a depth to 30 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 6. It is sandy loam or fine sandy loam in the fine earth.

The BC horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It ranges from fine sandy loam to loamy sand in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 3 to 6. It is dominantly stratified sand and gravel; the individual layers range from sandy loam to sand in the fine earth to dominantly gravel.

Tilsit Series

The soils of the Tilsit series are fine-silty, mixed, mesic Typic Fragiudults. They are deep and moderately well drained and are on broad ridgetops mainly in the southern half of the county. The soils formed dominantly in residuum of weathered siltstone interbedded with shale and fine-grained sandstone. Slope ranges from 0 to 8 percent.

Tilsit soils are on the landscape with well drained Gilpin, Weikert, and Clymer soils; moderately well drained Ernest and Wharton soils; somewhat poorly drained Cavode soils; and poorly drained Brinkerton soils. The Tilsit soils contain more silt above the fragipan than the Ernest soils, and the Wharton soils do not have a fragipan.

Typical pedon of Tilsit silt loam, 3 to 8 percent slopes, in a cultivated field 0.25 mile southwest of Lernerville, on the north side of Township Route 612, 1,400 feet west of its intersection with PA 356, 50 feet west of utility pole number 30608 and 150 feet east of the farm lane:

Ap—0 to 8 inches, dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable, slightly sticky, nonplastic; 1 percent rock fragments; neutral; abrupt wavy boundary.

EB—8 to 11 inches, yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure parting to weak medium granular; friable, slightly sticky, slightly plastic; 1 percent rock fragments; slightly acid; clear wavy boundary.

Bt1—11 to 16 inches, yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable, sticky, plastic; few faint clay films on faces of peds and in pores; moderately acid; clear wavy boundary.

Bt2—16 to 20 inches, yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/6)), brown (7.5YR 5/4), and pale brown (10YR 6/3) mottles; moderate fine subangular blocky; friable or slightly firm, sticky, plastic; 1 percent rock fragments; common faint clay films on faces of peds and in pores; strongly acid; gradual wavy boundary.

Bt3—20 to 25 inches, yellowish brown (10YR 5/4) silt loam; many fine prominent brown (7.5YR 5/4, 10YR 5/3), pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to moderate medium and fine angular blocky; slightly firm, sticky, plastic; 2 percent rock fragments; common distinct clay films on faces of peds and in pores; very strongly acid; clear wavy boundary.

Btx1—25 to 31 inches, yellowish brown (10YR 5/4) silt loam; many fine and medium prominent light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy and moderate fine angular blocky; very firm and brittle, sticky, plastic; 3 to 5 percent rock fragments; common distinct clay films on faces of peds and in pores; pale brown (10YR 6/3) prism coatings; very strongly acid; gradual wavy boundary.

Btx2—31 to 40 inches, yellowish brown (10YR 5/4) silt loam; many medium and fine prominent light brownish gray (10YR 6/2), brown (7.5YR 5/4), and yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate thick platy and weak fine angular blocky; very firm and brittle, slightly sticky, slightly plastic; 6 percent rock fragments; common distinct clay films on faces of peds and in pores; pale brown (10YR 6/3) prism coatings; very strongly acid; gradual wavy boundary.

Btx3—40 to 55 inches, yellowish brown (10YR 5/4) silt loam; many medium prominent light gray (10YR 7/2), brown (7.5YR 5/4), and yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate thick and very thick platy and weak medium angular blocky; very frim and brittle, sticky, slightly plastic; 5 to 10 percent rock fragments; common distinct clay films on faces of peds and in pores; light gray (10YR 7/2) prism coatings; very strongly acid; gradual wavy boundary.

C—55 to 60 inches, dark yellowish brown (10YR 4/4) very channery silt loam; common fine prominent light gray (10YR 7/2) and brown (7.5YR 5/4) mottles; weak very coarse prismatic structure parting to moderate very thick platy inherited from shale bedding planes; firm, sticky, slightly plastic; 50 percent rock fragments; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to the fragipan ranges from 18 to 28 inches, and the depth to bedrock is 40 inches or more. The content of rock fragments ranges from 0 to 10 percent in the Ap and Bt horizons and the upper part of the Btx horizons, and from 10 to 80 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 8. Mottles with chroma of 2 or less are below the upper 10 inches of the Bt horizon. The Bt horizon is silt loam, loam, or silty clay loam.

The Btx horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. It is mottled. It is silty clay loam, silt loam, or loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. It is mottled. It ranges from silt loam or loam to silty clay in the fine earth.

Titusville Series

The soils of the Titusville series are fine-loamy, mixed, mesic Aquic Fragiudalfs. They are very deep and moderately well drained and are on undulating and rolling till plains and moraines in the northwest part of the county. The soils formed in glacial till derived mostly from shale, siltstone, and sandstone. Slope ranges from 3 to 30 percent.

Titusville soils are on the landscape with well drained Wheeling and Riverhead soils, moderately well drained Braceville soils, somewhat poorly drained Gresham soils, and poorly drained Frenchtown soils. The Titusville soils contain more clay than the Braceville soils, and the substratum in the Titusville soils is not as sandy as that in the Braceville soils.

Typical pedon of Titusville silt loam, 3 to 8 percent slopes, in a hay field 1 mile east of Slippery Rock, on the west side of Township Route 376 (Harmony Road), 0.25 mile south of its intersection with Legislative Route 10068 and 18 feet north of utility pole no. 381355:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; neutral; abrupt smooth boundary.

BE—9 to 13 inches, yellowish brown (10YR 5/4) silt loam; weak medium platy structure parting to medium fine and very fine subangular blocky; friable, sticky, slightly plastic; 1 percent rock fragments; slightly acid; clear wavy boundary.

Bt1—13 to 18 inches, yellowish brown (10YR 5/4) silt loam; moderate medium and fine angular and subangular blocky structure; friable, sticky, plastic; 2 percent rock fragments; common faint clay films on faces of peds and in pores; strongly acid; clear wavy boundary.

Bt2—18 to 23 inches, yellowish brown (10YR 5/4) silt loam; many fine prominent strong brown (7.5YR 5/6), light brownish gray (10YR 6/2 and 2.5Y 6/2), and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium angular and subangular blocky; friable, firm in lower part, sticky, plastic; 2 percent rock fragments; continuous distinct clay films on faces of peds and in pores; very strongly acid; clear wavy boundary.

Btx1—23 to 36 inches, yellowish brown (10YR 5/6) silt loam; many medium and fine prominent strong brown (7.5YR 5/6), grayish brown (10YR 5/2), and light brownish gray (2.5Y 6/2, 10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate thick and very thick platy; very firm and brittle, sticky, plastic; 3 percent rock fragments; continuous distinct clay films on faces of peds and in pores; light brownish gray (2.5Y 6/2) coating on prism and smaller ped faces; very strongly acid; gradual wavy boundary.

Btx2—36 to 41 inches, strong brown (7.5YR 5/6) loam; common medium prominent light olive gray (5Y 6/2) and yellowish brown (10YR 5/4, and 10YR 5/6) mottles; moderate coarse and very coarse prismatic structure parting to weak coarse subangular blocky; very firm, brittle, sticky, slightly plastic; 3 percent rock fragments; continuous prominent clay films on prisms, many distinct clay films on faces of interior peds and in pores; light olive gray (5Y 6/2) prism coatings; strongly acid; gradual wavy boundary.

Btx3—41 to 50 inches, strong brown (7.5YR 5/6) loam; many medium prominent gray (5Y 6/1) and yellowish brown (10YR 5/4 and 10YR 5/6) mottles; strong very coarse prismatic structure with massive interiors showing some tendency to be platy and blocky; very firm, brittle, sticky, slightly plastic; 3 percent rock fragments; continuous distinct clay films on faces of prisms and many distinct clay films in pores; gray (5Y 6/1) prism coatings; strongly acid; gradual wavy boundary.

Btx4—50 to 60 inches, brown (10YR 5/3) clay loam; common fine distinct yellowish brown (10YR 5/4, 5/6) and grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure; very firm, sticky, plastic; gray (5Y 6/1) prism coatings; 5 percent rock fragments; moderately acid.

The solum ranges from 50 to 100 inches in thickness. The depth to bedrock is more than 60 inches, and the depth to the fragipan ranges from 16 to 28 inches. The content of rock fragments ranges from 0 to 20 percent in the upper 16 inches, 2 to 30 percent throughout the rest of the solum, and 5 to 35 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid in the upper 40 inches and from strongly acid to neutral below a depth of 40 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3.

The BE and Bt horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Low-chroma mottles are in the upper 10 inches of the Bt horizon. The BE and Bt horizons range from loam to silty clay loam in the fine earth.

The Btx horizon has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 2 to 6. It is mottled. It is silt loam, loam, clay loam, or silty clay loam in the fine earth. Prism coatings have dominant chroma of 2 or less.

Some pedons have a C horizon that has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 2 to 6. It is mottled. It is dominantly loam or clay loam in the fine earth.

Udorthents

Udorthents consist of very deep, moderately well drained to excessively drained soils formed by the mixing of soils and bedrock during the strip mining of coal and, to a lesser extent, limestone. Udorthents are on ridgetops, side slopes, benches, lowlands, and flood plains. They are throughout the county but are dominantly in the northern half. Slope ranges from 0 to 100 percent.

Udorthents are commonly near Gilpin, Weikert, Hazleton, Ernest, Buchanan, Wharton, and Cavode soils. Udorthents do not have diagnostic horizons.

A typical pedon of Udorthents is not given because of the variability of the soils.

The solum ranges from 0 to 10 inches in thickness. The depth to bedrock is mainly more than 6 feet. The content of rock fragment ranges from 30 to 95 percent throughout. Reaction ranges from extremely acid to moderately alkaline but is dominantly extremely acid to moderately acid.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 1 to 3. It ranges from sandy loam to silt loam in the fine earth.

The C horizon has dominant hue of 7.5YR to 5Y, value of 3 to 5, and chroma of 1 to 6. It is mottled in some pedons. It ranges from loamy sand to silty clay in the fine earth.

Upshur Series

The soils of the Upshur series are fine, mixed, mesic Typic Hapludalfs. They are deep and well drained and are on ridges, hillsides, and benches on dissected uplands mainly in the southern part of the county. The soils formed in residuum of weathered red shale interbedded with acid, gray and brown siltstone and shale. Slope ranges from 8 to 30 percent.

Upshur soils in Butler County are mapped only with moderately deep Gilpin soils. Upshur soils are on the landscape with shallow Weikert soils, Hazleton soils, moderately well drained Wharton and Ernest soils, moderately well drained to somewhat poorly drained Vandergift soils, and somewhat poorly drained Cavode soils. The Upshur soils contain more clay throughout than the Hazleton soils.

Typical pedon of Upshur silty clay loam, in an area of Gilpin-Upshur complex, 15 to 30 percent slopes, in a hay field 4 miles west of Mars, 400 feet southwest of the intersection of PA 228 and Legislative Route 10005:

Ap—0 to 6 inches, dark brown (7.5YR 3/2) silty clay loam, pinkish gray (7.5YR 6/2) dry; moderate medium granular structure; friable, slightly sticky, plastic; neutral; abrupt wavy boundary.

Bt1—6 to 10 inches, reddish brown (5YR 4/4) clay; strong fine and medium angular blocky structure; firm, sticky, plastic; many faint clay films on faces of peds; moderately acid; clear wavy boundary.

Bt2—10 to 16 inches, reddish brown (5YR 4/4) clay; moderate medium prismatic structure parting to strong fine and medium angular blocky; firm, sticky, plastic; many distinct clay films on faces of peds; moderately acid; clear wavy boundary.

Bt3—16 to 23 inches, reddish brown (5YR 4/4) clay; weak medium prismatic structure parting to moderate medium subangular blocky; firm, sticky, plastic; many distinct clay films on faces of peds; moderately acid; clear wavy boundary.

BCt—23 to 34 inches, dark reddish brown (2.5YR 3/4) clay; weak medium subangular blocky structure; firm, sticky, plastic; many distinct clay films on faces of peds; slightly acid; abrupt wavy boundary.

C1—34 to 46 inches, dusky red (10YR 3/4) channery clay; massive; firm, sticky, plastic; 25 percent rock fragments; slightly acid; gradual wavy boundary.

C2—46 to 56 inches, dusky red (10R 3/4) channery silty clay loam; massive; firm, sticky, plastic; 30 percent rock fragments; neutral; clear wavy boundary.

C3—56 to 69 inches, dusky red (10R 3/4) very channery silty clay loam; massive in place parting to blocky shale structure; friable, sticky, slightly plastic; 60 percent rock fragments; neutral; gradual wavy boundary.

C4—69 to 77 inches, dusky red (10R 3/4) extremely channery silty clay loam; common black (N 2/0) and yellowish brown (10YR 5/6) lenses; massive in place parting to blocky shale structure; friable, sticky, slightly plastic; 75 percent rock fragments; neutral; gradual wavy boundary.

R—77 inches red (10R 3/4) shale.

The solum ranges from 26 to 50 inches in thickness, and the depth to bedrock is 40 inches or more. The content of rock fragments ranges from 0 to 10 percent in the upper part of the solum, from 0 to 25 percent in the lower part of the solum, and from 5 to 75 percent in the C horizon. In unlimed areas reaction ranges from very strongly acid to slightly acid in the solum and from strongly acid to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR to 2.5YR, value of 2 to 4, and chroma of 2 to 4.

The B horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. The Bt horizon is silty clay or clay in the fine earth. The BC horizon is silty clay loam, silty clay, or clay in the fine earth.

The C horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. In some pedons it is variegated with olive brown, olive, and yellow. It ranges from silty clay loam to clay in the fine earth.

Vandergrift Series

The soils of the Vandergrift series are fine, mixed, mesic Aquic Hapludalfs. They are deep and moderately well drained and somewhat poorly drained and are on ridgetops, hillsides, benches, and foot slopes mainly in the southern half of the county. The soils formed in residuum of weathered interbedded calcareous and noncalcareous, red and gray shale and siltstone. Slope ranges from 3 to 25 percent.

Vandergrift soils are mapped with somewhat poorly drained Cavode soils but are redder and less acid than the Cavode soils. Vandergrift soils are on the landscape with well drained Gilpin and Upshur soils, moderately well drained Wharton and Ernest soils, and poorly drained Brinkerton soils. The Vandergrift soils are redder, less acid, and more clayey than the Wharton and Ernest soils and do not have the fragipan that is typical of the Ernest soils.

Typical pedon of Vandergrift silt loam, in an area of Vandergrift-Cavode silt loams, 3 to 8 percent slopes, in a hay field 2.5 miles northeast of Glade Mills, 100 feet northeast of Township Route 484, 1,850 feet southeast of its intersection with Township Route 482:

Ap—0 to 7 inches, reddish brown (5YR 4/4) silt loam; weak fine subangular blocky structure parting to

moderate medium granular; friable, slightly sticky, plastic; moderately acid; abrupt smooth boundary.
Bt1—7 to 15 inches, reddish brown (2.5YR 4/4) silty clay; moderate medium prismatic structure parting to moderate medium angular blocky; friable, sticky, plastic; continuous faint clay films on faces of peds and in pores; reddish brown (5YR 4/3) ped coatings; 1 percent rock fragments; moderately acid; clear smooth boundary.
Bt2—15 to 26 inches, weak red (10YR 4/4) silty clay; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate coarse angular blocky; firm, sticky, plastic; continuous distinct clay films on faces of peds and in pores; reddish gray (5R 5/2) and reddish brown (2.5YR 4/4) prism and ped coatings; 1 percent rock fragments; strongly acid; clear wavy boundary.
Bt3—26 to 41 inches, weak red (10R 4/4) silty clay; common medium prominent light gray (10YR 6/1) and red (2.5YR 4/6) mottles; weak coarse prismatic structure parting to moderate coarse angular blocky; firm, sticky, plastic; common distinct clay films on faces of peds and lining pores; 2 percent rock fragments; moderately acid; gradual wavy boundary.
BCt—41 to 50 inches, weak red (10R 4/4) silty clay; gray (10YR 6/1) lenses and streaks; weak coarse subangular blocky structure, massive in the lower part; firm, sticky, plastic; common distinct clay films on rock fragments and lining pores; 10 percent rock fragments; moderately acid; clear wavy boundary.
C—50 to 58 inches, weak red (10R 4/2) very channery silty clay loam; black coatings on rock fragments and gray (10YR 5/1) lenses and streaks; massive; friable, sticky,plastic; 35 percent rock fragments; neutral; abrupt wavy boundary.
R—58 inches, fractured dusky red (10R 3/3) shale.

The solum ranges from 35 to 60 inches in thickness, and the depth to bedrock is 40 to 80 inches. The content of rock fragments ranges from 0 to 10 percent in the solum and from 0 to 90 percent in the C horizon. In unlimed areas reaction ranges from very strongly acid to slightly acid in the solum and from strongly acid to mildly alkaline in the C horizon.

The A horizon has hue of 10YR to 2.5YR, value of 3 or 4, and chroma of 2 to 4.

Some pedons have a BE horizon with hue of 7.5YR to 2.5YR, value of 3 to 5, and chroma of 2 to 4. It is silty clay loam or silty clay.

The Bt horizon has hue of 5YR to 10R, value of 3 to 5, and chroma of 2 to 6. Low-chroma mottles begin in the upper 10 inches of the Bt horizon. The Bt horizon is silty clay loam, silty clay, or clay.

The C horizon has hue of 10YR to 10R, value of 3 to 6, chroma of 2 to 6, and it is commonly streaked with contrasting colors. It ranges from silt loam to clay in the fine earth.

Weikert Series

The soils of the Weikert series are loamy-skeletal, mixed, mesic Lithic Dystrochrepts. They are shallow and well drained and are on ridges, side slopes, and hillsides throughout the county. The soils formed in residuum of weathered interbedded siltstone, shale, and some sandstone. Slope ranges from 3 to 70 percent.

Weikert soils in Butler County are mapped only with moderately deep Gilpin soils but are on the landscape with deep Hazleton soils; moderately well drained Wharton, Tilsit, and Ernest soils; somewhat poorly drained Cavode soils; and poorly drained Brinkerton soils.

Typical pedon of Weikert channery silt loam, in an area of Gilpin-Weikert channery silt loams, 3 to 8 percent slopes, in a hay field 0.25 mile southeast of Hooker, on the west side of Township Route 404, 3,000 feet north-northwest of the railroad crossing and 100 feet south of the bend in Township Route 404:

Ap—0 to 6 inches, dark brown (10YR 4/3) channery silt loam; weak fine granular structure; friable, slightly sticky, nonplastic; 25 percent rock fragments; very strongly acid; abrupt smooth boundary.
Bw—6 to 13 inches, yellowish brown (10YR 5/4) very channery silt loam; weak medium platy and very fine subangular blocky structure; friable, slightly sticky, slightly plastic; 35 percent rock fragments; very strongly acid; clear wavy boundary.
C—13 to 16 inches, yellowish brown (10YR 5/4) extremely channery silt loam; weak medium platy structure inherited from shale bedding planes; friable, slighty sticky, slightly plastic; 70 percent rock fragments; very strongly acid; abrupt wavy boundary.
R—16 inches, fractured brown (10YR 5/3) siltstone.

The solum ranges from 10 to 20 inches in thickness, and the depth to bedrock is 10 to 20 inches. The content of rock fragments ranges from 20 to 50 percent in the Ap horizon, 30 to 65 percent in the B horizon, and 60 to 85 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam or loam in the fine earth.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam or loam in the fine earth.

Wharton Series

The soils of the Wharton series are fine-loamy, mixed, mesic Aquic Hapludults. They are deep and moderately well drained and are on broad ridgetops and side slopes on dissected uplands throughout all but the extreme northwest corner of the county. The soils formed in residuum of weathered shale and siltstone. Slope ranges from 0 to 25 percent.

The Wharton soils are on the landscape with well drained Gilpin and Clymer soils, moderately well drained Tilsit and Ernest soils, somewhat poorly drained Cavode soils, and poorly drained Brinkerton soils. The Wharton soils do not have a fragipan, which is a characteristic of the Tilsit and Ernest soils.

Typical pedon of Wharton silt loam, 3 to 8 percent slopes, in a cultivated area 15 miles south of Eldorado, 210 feet west of the intersection of Township Routes 632 and 725, and 285 feet south of Township Route 632:

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; strongly acid; abrupt smooth boundary.

Bt1—9 to 16 inches, yellowish brown (10YR 5/4) silt loam; moderate fine subangular and angular blocky structure; friable, sticky, plastic; common faint clay films on faces of peds and lining pores; 1 percent rock fragments; very strongly acid; clear wavy boundary.

Bt2—16 to 22 inches, yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; friable, sticky, plastic; many distinct clay films on faces of peds and lining pores; 1 percent rock fragments; very strongly acid; clear wavy boundary.

Bt3—22 to 31 inches, brown (10YR 5/3) silt loam; many medium prominent light gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; friable but becoming firm in the lower part, sticky, plastic; continuous distinct clay films on faces of peds and in pores; light brownish gray (10YR 6/2) prism coatings; 2 percent rock fragments; extremely acid; gradual wavy boundary.

Bt4—31 to 46 inches, dark yellowish brown (10YR 4/4) silty clay loam; common coarse prominent strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and light gray (10YR 6/1) mottles; moderate coarse prismatic structure parting to weak coarse angular blocky; firm, sticky, plastic; continuous prominent gray (10YR 6/1) prism coatings and many distinct clay films on faces of peds and lining pores; 10 percent rock fragments; extremely acid; gradual wavy boundary.

C—46 to 69 inches, brown (10YR 5/3) channery silty clay loam; common medium distinct yellowish brown (10YR 5/6) and gray (N 6/0) mottles; very weak coarse prismatic structure; very firm, sticky, plastic; 20 percent rock fragments; few gray (10YR 6/1) prism coatings; extremely acid; abrupt wavy boundary.

R—69 inches, brown (10YR 5/3) rippable shale.

The solum ranges from 30 to 60 inches in thickness, and the depth to bedrock ranges from 40 to 72 inches. The content of rock fragments ranges from 0 to 20 percent in the A, BE, amd Bt horizons, 5 to 50 percent in the BC horizon, and 20 to 90 percent in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid throughout the solum and strongly acid to extremely acid in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3.

Some pedons have a BE horizon with hue of 2.5Y to 7.5YR, value of 5, and chroma of 4 to 6. It is silt loam.

The Bt horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 8. Low-chroma mottles are in the upper 24 inches of the Bt horizon. Prisms and faces of peds in the lower part of the Bt horizon have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. The Bt horizon is dominantly silt loam or silty clay loam, but some pedons contain subhorizons of clay loam, loam, or silty clay in the fine earth.

Some pedons have a BC horizon with hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is mottled. It ranges from silt loam to silty clay in the fine earth.

The C horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6, it is generally mottled. It ranges from silt loam to silty clay in the fine earth.

Wheeling Series

The soils of the Wheeling series are fine-loamy, mixed, mesic Ultic Hapludalfs. They are very deep and well drained and are on outwash plains, kames, and terraces dominantly in the northwest part of the county and along the Connoquenessing Creek. The soils formed in silty or loamy material underlain by stratified sand and gravel. Slope ranges from 0 to 8 percent.

Wheeling soils are on the landscape with well drained Riverhead soils, moderately well drained Braceville and Monongahela soils, somewhat poorly drained Caneadea soils, and somewhat poorly drained and poorly drained Fredon soils. The Wheeling soils contain more clay and less sand in the upper part of the solum than the Riverhead soils.

Typical pedon of Wheeling silt loam, 0 to 3 percent slopes, in cropland 1 mile west of the crossroads in West Liberty Borough, 75 feet south of Township Route 396 at a point 0.5 mile south and east of the intersection

of Legislative Route 10065 and Township Route 396, and 0.5 mile north and west of the intersection of Township Routes 368 and 396:

Ap—0 to 9 inches, dark brown (10YR 4/3) silt loam; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; 1 percent rock fragments; neutral; abrupt smooth boundary.

BE—9 to 12 inches, yellowish brown (10YR 5/4) silt loam; weak medium and fine subangular blocky structure; friable, sticky, slightly plastic; strongly acid; clear smooth boundary.

Bt1—12 to 24 inches, brown (7.5YR 5/4) silt loam; weak medium and fine subangular blocky structure; friable, sticky, plastic; common faint clay films on faces of peds and in pores; strongly acid; clear smooth boundary.

Bt2—24 to 30 inches, brown (7.5YR 5/4) silt loam; moderate medium and fine subangular blocky structure; friable, sticky, plastic; many faint clay films on faces of peds and in pores; 1 percent rock fragments, strongly acid; clear wavy boundary.

Bt3—30 to 36 inches, brown (7.5YR 5/4) and strong brown (7.5YR 5/6) loam; weak very thick platy structure parting to weak medium subangular blocky; firm, sticky, slightly plastic; many faint clay films on faces of peds and in pores; 3 percent rock fragments; strongly acid; clear smooth boundary.

BCt—36 to 40 inches, brown (7.5YR 4/4) sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak very thick and thick platy structure parting to weak medium subangular blocky; firm, slightly sticky, nonplastic; common faint clay films on faces of peds, on rock fragments; and in pores; 3 percent rock fragments; strongly acid; abrupt smooth boundary.

2C1—40 to 48 inches, dark yellowish brown (10YR 4/4) loamy sand; many fine distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles and lenses; weak very thick platy structure in upper part and massive in lower part; very friable, nonsticky, nonplastic; 5 percent rock fragments; moderately acid; clear smooth boundary.

2C2—48 to 60 inches, yellowish brown (10YR 5/4) very gravelly loamy sand; common medium and fine distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles and lenses; massive; loose, nonsticky, nonplastic; 40 percent rock fragments; moderately acid.

The solum ranges from 40 to 60 inches in thickness, and the depth to bedrock is more than 60 inches. The content of rock fragments in the solum ranges from 0 to 25 percent to a depth of 40 inches and from 0 to 50 percent below a depth of 40 inches. In unlimed areas reaction is strongly acid or moderately acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The BE and the upper part of the Bt horizon are loam, silt loam, or silty clay loam. The lower part of the Bt horizon and the BCt horizon are very fine sandy loam or sandy loam in the fine earth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 3 to 6. It is dominantly stratified sand and gravel, but individual layers range from sandy loam to sand in the fine earth.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage and planting system in which crop residue covers at least 30 percent of the soil surface after planting. Where soil erosion by wind is the main concern, the system leaves the equivalent of at least 1,000 pounds per acre of flat small-grain residue on the surface during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be

limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperture below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or

browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Much has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period the the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifiying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-81 at Slippery Rock, Pennsylvania]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	33.5	15.8	24.7	63	-12	26	2.71	1.54	3.74	8	13.1
February---	36.4	17.0	26.7	63	-12	16	2.37	1.19	3.39	7	10.3
March------	46.7	26.2	36.5	76	3	77	3.10	1.79	4.27	8	8.6
April------	59.2	35.5	47.4	84	17	253	3.67	2.26	4.93	9	1.4
May--------	69.9	44.1	57.0	89	26	527	3.67	2.20	4.97	9	.0
June-------	78.4	53.2	65.8	91	34	774	4.57	2.74	6.21	8	.0
July-------	81.9	57.5	69.7	93	42	921	4.12	2.37	5.67	8	.0
August-----	80.7	55.9	68.3	92	39	877	3.72	1.89	5.30	7	.0
September--	74.3	49.7	62.0	91	31	660	3.30	1.86	4.57	6	.0
October----	63.2	39.3	51.3	83	20	372	2.93	1.28	4.32	7	.1
November---	49.5	31.2	40.4	73	10	109	2.75	1.62	3.76	8	3.3
December---	37.7	21.8	29.8	67	-3	34	2.81	1.63	3.85	8	9.8
Yearly:											
Average--	59.3	37.3	48.3	---	---	---	---	---	---	---	---
Extreme--	---	---	---	93	-15	---	---	---	---	---	---
Total----	---	---	---	---	---	4,646	39.72	33.71	45.49	93	46.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-81 at Slippery Rock, Pennsylvania]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 28	May 11	June 4
2 years in 10 later than--	April 23	May 6	May 28
5 years in 10 later than--	April 14	April 26	May 14
First freezing temperature in fall:			
1 year in 10 earlier than--	October 15	October 1	September 21
2 years in 10 earlier than--	October 21	October 7	September 27
5 years in 10 earlier than--	November 2	October 19	October 8

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-81 at Slippery Rock, Pennsylvania]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	177	149	119
8 years in 10	186	158	128
5 years in 10	202	176	146
2 years in 10	218	193	163
1 year in 10	226	203	173

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AnA	Andover loam, 0 to 3 percent slopes	647	0.1
AnB	Andover loam, 3 to 8 percent slopes	3,255	0.6
AnC	Andover loam, 8 to 15 percent slopes	701	0.1
AoB	Andover loam, 0 to 8 percent slopes, very stony	2,121	0.4
AoC	Andover loam, 8 to 15 percent slopes, very stony	1,509	0.3
Ar	Arents-Urban land complex	3,904	0.8
At	Atkins silt loam	22,794	4.4
BeA	Braceville loam, 0 to 3 percent slopes	457	0.1
BeB	Braceville loam, 3 to 8 percent slopes	1,845	0.4
BeC	Braceville loam, 8 to 15 percent slopes	327	0.1
BrA	Brinkerton silt loam, 0 to 3 percent slopes	3,007	0.6
BrB	Brinkerton silt loam, 3 to 8 percent slopes	13,792	2.7
BrC	Brinkerton silt loam, 8 to 15 percent slopes	4,322	0.9
BuB	Buchanan loam, 3 to 8 percent slopes	6,303	1.2
BuC	Buchanan loam, 8 to 15 percent slopes	9,924	2.0
BxB	Buchanan loam, 0 to 8 percent slopes, very stony	2,363	0.5
BxD	Buchanan loam, 8 to 25 percent slopes, very stony	19,126	3.7
Cd	Canadice silty clay loam	2,610	0.5
CeA	Caneadea silt loam, 0 to 3 percent slopes	769	0.2
CeB	Caneadea silt loam, 3 to 8 percent slopes	1,603	0.3
CeC	Caneadea silt loam, 8 to 15 percent slopes	282	0.1
CeD	Caneadea silt loam, 15 to 25 percent slopes	848	0.2
ClA	Cavode silt loam, 0 to 3 percent slopes	1,352	0.3
ClB	Cavode silt loam, 3 to 8 percent slopes	12,535	2.5
ClC	Cavode silt loam, 8 to 15 percent slopes	14,318	2.8
ClD	Cavode silt loam, 15 to 25 percent slopes	4,147	0.8
CmB	Clymer loam, 3 to 8 percent slopes	3,058	0.6
CoA	Cookport loam, 0 to 3 percent slopes	1,362	0.3
CoB	Cookport loam, 3 to 8 percent slopes	10,298	2.0
CoC	Cookport loam, 8 to 15 percent slopes	6,879	1.4
CoD	Cookport loam, 15 to 25 percent slopes	6,224	1.2
Dd	Dumps, industrial waste	316	*
Dm	Dumps, mine	386	0.1
ErB	Ernest silt loam, 3 to 8 percent slopes	10,114	2.0
ErC	Ernest silt loam, 8 to 15 percent slopes	12,963	2.6
Fc	Fluvaquents, coal overwash	243	*
FeA	Fredon loam, 0 to 3 percent slopes	473	0.1
FeB	Fredon loam, 3 to 8 percent slopes	755	0.1
FrA	Frenchtown silt loam, 0 to 3 percent slopes	1,486	0.3
FrB	Frenchtown silt loam, 3 to 8 percent slopes	2,000	0.4
GlB	Gilpin silt loam, 3 to 8 percent slopes	10,060	2.0
GlC	Gilpin silt loam, 8 to 15 percent slopes	7,511	1.5
GmD	Gilpin channery silt loam, 15 to 25 percent slopes	5,221	1.0
GnC	Gilpin-Upshur complex, 8 to 15 percent slopes	302	0.1
GnD	Gilpin-Upshur complex, 15 to 30 percent slopes	664	0.1
GoB	Gilpin-Weikert channery silt loams, 3 to 8 percent slopes	6,227	1.2
GoC	Gilpin-Weikert channery silt loams, 8 to 15 percent slopes	7,449	1.5
GoD	Gilpin-Weikert channery silt loams, 15 to 25 percent slopes	11,042	2.2
GoF	Gilpin-Weikert channery silt loams, 25 to 70 percent slopes	12,472	2.5
GpC	Gilpin-Wharton siltloams, 8 to 15 percent slopes	25,136	4.8
GpD	Gilpin-Wharton complex, 15 to 25 percent slopes	26,396	5.2
GrA	Gresham silt loam, 0 to 3 percent slopes	821	0.2
GrB	Gresham silt loam, 3 to 8 percent slopes	9,497	1.9
GrC	Gresham silt loam, 8 to 15 percent slopes	1,259	0.2
HaB	Hazleton channery loam, 3 to 8 percent slopes	13,522	2.7
HaC	Hazleton channery loam, 8 to 15 percent slopes	17,090	3.4
HaD	Hazleton channery loam, 15 to 25 percent slopes	19,144	3.8
HaE	Hazleton channery loam, 25 to 35 percent slopes	7,254	1.4
HbB	Hazleton loam, 0 to 8 percent slopes, very stony	2,394	0.5
HgD	Hazleton and Gilpin soils, 8 to 25 percent slopes, very stony	15,466	3.0
HgF	Hazleton and Gilpin soils, 25 to 70 percent slopes, very stony	14,658	2.9
MoB	Monongahela silt loam, 3 to 8 percent slopes	1,348	0.3
MoC	Monongahela silt loam, 8 to 15 percent slopes	236	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Ph	Philo loam	2,787	0.5
Pn	Pits, sand and gravel	231	*
Po	Pope loam	404	0.1
RdB	Riverhead sandy loam, 3 to 8 percent slopes	1,028	0.2
RdC	Riverhead sandy loam, 8 to 15 percent slopes	1,111	0.2
TaA	Tilsit silt loam, 0 to 3 percent slopes	1,324	0.3
TaB	Tilsit silt loam, 3 to 8 percent slopes	8,648	1.7
TeB	Titusville silt loam, 3 to 8 percent slopes	6,698	1.3
TeC	Titusville silt loam, 8 to 15 percent slopes	3,297	0.6
TrD	Titusville and Riverhead soils, 15 to 30 percent slopes	1,668	0.3
UaB	Udorthents, acid material, gently sloping	1,961	0.4
UaD	Udorthents, acid material, moderately steep	13,970	2.7
UaF	Udorthents, acid material, very steep	12,155	2.4
UcD	Udorthents, calcareous material, moderately steep	949	0.2
UcF	Udorthents, calcareous material, very steep	457	0.1
UeB	Urban land-Ernest complex, 0 to 8 percent slopes	2,112	0.4
UeC	Urban land-Ernest complex, 8 to 15 percent slopes	400	0.1
UgD	Urban land-Gilpin complex, 15 to 25 percent slopes	389	0.1
VcB	Vandergrift-Cavode silt loams, 3 to 8 percent slopes	859	0.2
VcC	Vandergrift-Cavode silt loams, 8 to 15 percent slopes	2,348	0.5
VcD	Vandergrift-Cavode silt loams, 15 to 25 percent slopes	1,578	0.3
WaA	Wharton silt loam, 0 to 3 percent slopes	720	0.1
WaB	Wharton silt loam, 3 to 8 percent slopes	21,894	4.3
WaC	Wharton silt loam, 8 to 15 percent slopes	7,924	1.6
WhA	Wheeling silt loam, 0 to 3 percent slopes	361	0.1
WhB	Wheeling silt loam, 3 to 8 percent slopes	654	0.1
W	Water	5,646	1.1
	Total	508,160	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland.)

Map symbol	Soil name
BeA	Braceville loam, 0 to 3 percent slopes
BeB	Braceville loam, 3 to 8 percent slopes
BuB	Buchanan loam, 3 to 8 percent slopes
CmB	Clymer loam, 3 to 8 percent slopes
CoA	Cookport loam, 0 to 3 percent slopes
CoB	Cookport loam, 3 to 8 percent slopes
GlB	Gilpin silt loam, 3 to 8 percent slopes
HaB	Hazleton channery loam, 3 to 8 percent slopes
Ph	Philo loam
Po	Pope loam
RdB	Riverhead sandy loam, 3 to 8 percent
TaA	Tilsit silt loam, 0 to 3 percent slopes
TeB	Titusville silt loam, 3 to 8 percent slopes
WaA	Wharton silt loam, 0 to 3 percent slopes
WaB	Wharton silt loam, 3 to 8 percent slopes
WhA	Wheeling silt loam, 0 to 3 percent slopes
WhB	Wheeling silt loam, 3 to 8 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
AnA---------- Andover	IVw	85	17	60	---	---	2.5	5.0
AnB---------- Andover	IVw	85	17	60	---	---	2.5	5.0
AnC---------- Andover	IVw	85	17	60	---	---	2.5	5.0
AoB---------- Andover	VIIs	---	---	---	---	---	---	---
AoC---------- Andover	VIIs	---	---	---	---	---	---	---
Ar---------- Arents-Urban land	---	---	---	---	---	---	---	---
At---------- Atkins	IIIw	100	20	60	30	---	3.0	6.0
BeA---------- Braceville	IIw	110	24	85	---	4.5	3.5	6.5
BeB---------- Braceville	IIw	105	21	80	---	4.5	3.5	6.5
BeC---------- Braceville	IIIe	100	20	75	---	4.0	3.0	6.0
BrA---------- Brinkerton	IVw	90	18	60	---	---	2.5	5.0
BrB---------- Brinkerton	IVw	90	18	60	---	---	2.5	5.0
BrC---------- Brinkerton	IVw	85	17	45	---	---	2.5	5.0
BuB---------- Buchanan	IIe	100	---	65	40	3.5	3.0	6.0
BuC---------- Buchanan	IIIe	90	---	60	35	3.5	3.0	6.0
BxB, BxD---------- Buchanan	VIs	---	---	---	---	---	---	---
Cd---------- Canadice	IVw	75	15	60	---	---	2.5	5.0
CeA---------- Caneadea	IIIw	92	---	70	---	---	3.2	5.5
CeB---------- Caneadea	IIIw	94	---	72	---	---	3.2	5.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
CeC---------- Caneadea	IIIe	85	---	65	---	---	3.0	6.0
CeD---------- Caneadea	IVe	75	---	55	---	---	2.5	5.0
ClA---------- Cavode	IIIw	85	17	65	35	---	3.0	6.0
ClB---------- Cavode	IIIw	85	17	65	35	---	3.0	6.0
ClC---------- Cavode	IIIe	80	16	60	30	---	3.0	6.0
ClD---------- Cavode	IVe	75	15	55	25	---	2.5	5.0
CmB---------- Clymer	IIe	125	25	75	45	4.5	3.5	6.5
CoA---------- Cookport	IIw	100	20	65	40	3.5	3.0	6.0
CoB---------- Cookport	IIe	100	20	65	40	3.5	3.0	6.0
CoC---------- Cookport	IIIe	90	18	60	35	3.5	3.0	6.0
CoD---------- Cookport	IVe	90	16	55	35	3.0	2.5	5.0
Dd**, Dm**. Dumps								
ErB---------- Ernest	IIe	100	---	65	40	3.5	3.0	6.0
ErC---------- Ernest	IIIe	95	---	60	35	3.5	3.0	6.0
Fc. Fluvaquents								
FeA---------- Fredon	IIIw	100	20	60	---	---	3.0	6.0
FeB---------- Fredon	IIIw	100	20	60	---	---	3.0	6.0
FrA, FrB--------- Frenchtown	IIIw	90	18	70	---	---	2.5	5.0
GlB---------- Gilpin	IIe	90	---	65	40	3.5	3.0	6.0
GlC---------- Gilpin	IIIe	85	---	60	35	3.5	3.0	6.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
GmD---------- Gilpin	IVe	80	---	55	30	3.0	2.5	5.0
GnC---------- Gilpin-Upshur	IVe	88	---	61	35	3.7	3.0	6.0
GnD---------- Gilpin-Upshur	IVe	---	---	---	---	---	---	---
GoB---------- Gilpin-Weikert	IIIe	78	---	59	34	2.9	2.6	5.0
GoC---------- Gilpin-Weikert	IVe	---	---	53	29	2.9	2.6	5.0
GoD---------- Gilpin-Weikert	VIe	---	---	---	---	---	---	---
GoF---------- Gilpin-Weikert	VIIe	---	---	---	---	---	---	---
GpC---------- Gilpin-Wharton	IIIe	83	---	60	35	3.5	3.0	6.0
GpD---------- Gilpin-Wharton	IVe	77	---	55	30	3.0	2.5	5.0
GrA---------- Gresham	IIIw	80	---	66	---	---	3.5	6.5
GrB---------- Gresham	IIIw	75	---	66	---	---	3.5	6.5
GrC---------- Gresham	IIIe	70	---	60	---	---	3.2	6.0
HaB---------- Hazleton	IIe	125	25	75	45	4.5	3.5	6.5
HaC---------- Hazleton	IIIe	115	23	70	40	4.5	3.5	6.5
HaD---------- Hazleton	IVe	110	22	60	35	4.0	3.0	6.0
HaE---------- Hazleton	VIe	---	---	---	---	---	---	5.5
HbB---------- Hazleton	VIs	---	---	---	---	---	---	4.0
HgD---------- Hazleton and Gilpin	VIs	---	---	---	---	---	---	3.4
HgF---------- Hazleton and Gilpin	VIIs	---	---	---	---	---	---	---
MoB---------- Monongahela	IIe	110	22	65	40	3.5	3.0	6.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
MoC---------- Monongahela	IIIe	90	18	60	35	3.0	3.0	6.0
Ph---------- Philo	IIw	130	---	80	45	4.5	3.5	6.5
Pn**. Pits								
Po---------- Pope	Iw	130	---	80	45	---	4.0	7.5
RdB---------- Riverhead	IIs	95	19	70	60	---	3.0	6.0
RdC---------- Riverhead	IIIe	85	17	65	50	---	3.0	6.0
TaA---------- Tilsit	IIw	105	---	70	45	3.5	3.0	6.0
TaB---------- Tilsit	IIe	105	---	70	45	3.5	3.0	6.0
TeB---------- Titusville	IIe	95	---	70	---	---	3.8	---
TeC---------- Titusville	IIIe	90	---	65	---	---	3.6	---
TrD---------- Titusville and Riverhead	VIe	---	---	---	---	---	---	---
UaB, UaD, UaF, UcD, UcF. Udorthents								
UeB---------- Urban land-Ernest	---	---	---	---	---	---	---	---
UeC---------- Urban land-Ernest	---	---	---	---	---	---	---	---
UgD---------- Urban land-Gilpin	---	---	---	---	---	---	---	---
VcB---------- Vandergrift-Cavode	IIIw	87	17	65	37	---	3.0	6.0
VcC---------- Vandergrift-Cavode	IIIe	80	16	60	33	---	3.0	6.0
VcD---------- Vandergrift-Cavode	IVe	72	14	55	28	---	2.5	5.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
WaA---------- Wharton	IIw	90	18	65	40	3.5	3.0	6.0
WaB---------- Wharton	IIe	90	18	65	40	3.5	3.0	6.0
WaC---------- Wharton	IIIe	80	16	60	35	3.5	3.0	6.0
WhA---------- Wheeling	I	125	---	75	45	4.5	---	---
WhB---------- Wheeling	IIe	125	---	75	45	4.5	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	765	---	---	---
II	102,120	116,832	8,495	1,028
III	171,776	116,832	54,944	---
IV	100,307	71,973	28,334	---
V	---	---	---	---
VI	59,313	19,964	---	39,349
VII	30,760	12,472	---	18,288
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
AnA, AnB-------- Andover	4W	Slight	Severe	Severe	Moderate	Northern red oak---- Yellow poplar--------	75 83	4 5	Eastern white pine, Norway spruce, yellow poplar.
AnC-------------- Andover	4W	Moderate	Severe	Severe	Moderate	Northern red oak---- Yellow poplar--------	75 83	4 5	Eastern white pine, Norway spruce, yellow poplar.
AoB-------------- Andover	4W	Slight	Severe	Severe	Moderate	Northern red oak---- Yellow poplar--------	75 83	4 5	Eastern white pine, Norway spruce, yellow poplar.
AoC-------------- Andover	4W	Moderate	Severe	Severe	Moderate	Northern red oak---- Yellow poplar--------	75 83	4 5	Eastern white pine, Norway spruce, yellow poplar.
At--------------- Atkins	3W	Slight	Severe	Severe	Moderate	Red maple----------- Pin oak------------- American sycamore---	60 85 ---	3 5 ---	Eastern white pine, white spruce, European black alder.
BeA, BeB, BeC--- Braceville	4A	Slight	Slight	Slight	Slight	Northern red oak---- White ash----------- Yellow poplar--------	80 --- ---	4 --- ---	Eastern white pine, Japanese larch, Norway spruce, black cherry, yellow poplar.
BrA, BrB, BrC--- Brinkerton	4W	Slight	Severe	Severe	Moderate	Northern red oak----	77	4	Eastern white pine, Norway spruce, red maple, yellow poplar.
BuB, BuC--------- Buchanan	4A	Slight	Slight	Slight	Slight	Northern red oak---- Yellow poplar--------	75 90	4 6	Yellow poplar, eastern white pine, Japanese larch, Norway spruce, red oak.
BxB, BxD--------- Buchanan	4A	Slight	Slight	Slight	Slight	Northern red oak---- Yellow poplar--------	75 90	4 6	Japanese larch, oak, yellow poplar, red oak, eastern white pine, Norway spruce.
Cd--------------- Canadice	2W	Slight	Severe	Severe	Moderate	Red maple----------- Pin oak------------- Sycamore------------	50 --- ---	2 --- ---	Eastern white pine, white spruce, European black alder.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
CeA, CeB-------- Caneadea	4C	Slight	Slight	Severe	Severe	Northern red oak---- Yellow poplar------- White ash----------- Black cherry-------- Slippery elm-------- Red maple---------- White oak-----------	70 --- --- --- --- --- ---	4 3 --- --- --- --- ---	Yellow poplar, Austrian pine, Japanese larch, Norway spruce, European black alder.
CeC------------- Caneadea	4C	Moderate	Moderate	Severe	Severe	Northern red oak---- Yellow poplar------- White ash----------- Black cherry-------- Slippery elm-------- Red maple---------- White oak-----------	70 --- --- --- --- --- ---	4 --- --- --- --- --- ---	Yellow poplar, Austrian pine, Japanese larch, Norway spruce, European black alder.
CeD------------- Caneadea	4C	Severe	Severe	Severe	Severe	Northern red oak---- Yellow poplar------- White ash----------- Black cherry-------- Slippery elm-------- Red maple---------- White oak-----------	70 --- --- --- --- --- ---	4 3 --- --- --- --- ---	Yellow poplar, Austrian pine, Japanese larch, Norway spruce, European black alder.
ClA, ClB-------- Cavode	4W	Slight	Moderate	Moderate	Moderate	Northern red oak---- Yellow poplar------- White ash----------- Black cherry--------	82 95 --- ---	4 7 --- ---	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, red oak, Japanese larch.
ClC------------- Cavode	4W	Moderate	Moderate	Moderate	Moderate	Northern red oak---- Yellow poplar------- White ash----------- Black cherry--------	82 95 --- ---	4 7 --- ---	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, red oak, Japanese larch.
ClD------------- Cavode	4W	Severe	Moderate	Moderate	Moderate	Northern red oak---- Yellow poplar------- White ash----------- Black cherry--------	82 95 --- ---	4 7 --- ---	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, red oak, Japanese larch.
CmB------------- Clymer	4A	Slight	Slight	Slight	Slight	Northern red oak---- Yellow poplar------- Eastern white pine-- Black cherry--------	70 83 --- 75	4 5 3 ---	Eastern white pine, Norway spruce, black cherry, red oak, yellow poplar, Japanese larch.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
CoA, CoB, CoC--- Cookport	4W	Slight	Moderate	Slight	Slight	Northern red oak---- Black cherry-------- Yellow poplar------- White ash---------- Sugar maple---------	76 80 90 75 ---	4 4 6 4 4	Yellow poplar, eastern white pine, black cherry, red oak, Japanese larch, Norway spruce, sugar maple.
CoD---------- Cookport	4W	Moderate	Moderate	Slight	Slight	Northern red oak---- Black cherry-------- Yellow poplar------- White ash---------- Sugar maple---------	76 80 90 75 ---	4 4 6 3 ---	Yellow poplar, eastern white pine, black cherry, red oak, Japanese larch, Norway spruce, sugar maple.
ErB---------- Ernest	4W	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow poplar------- White ash---------- Sugar maple--------- Black cherry--------	75 80 71 69 74	4 5 3 3 3	Eastern white pine, Norway spruce, Japanese larch, yellow poplar, red oak.
ErC---------- Ernest	4W	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow poplar------- White ash---------- Sugar maple--------- Black cherry--------	75 85 71 69 74	4 6 4 4 4	Eastern white pine, Norway spruce, Japanese larch, yellow poplar, red oak.
FeA, FeB-------- Fredon	3W	Slight	Severe	Severe	Severe	Northern red oak---- Yellow poplar------- Eastern white pine-- Red maple----------	60 --- --- ---	3 --- --- ---	Yellow poplar, eastern white pine, white spruce, Norway spruce.
FrA, FrB-------- Frenchtown	5W	Slight	Severe	Moderate	Moderate	White ash---------- Yellow poplar------- Sugar maple--------- Northern red oak---- Black cherry-------- Pin oak----------	85 93 --- --- --- ---	5 7 --- --- --- ---	Eastern white pine, yellow poplar, Japanese larch, Norway spruce, white ash.
GlB, GlC-------- Gilpin	4A	Slight	Slight	Slight	Slight	Northern red oak---- Yellow poplar-------	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
GmD---------- Gilpin	4R	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow poplar-------	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
GnC**:									
Gilpin	4A	Slight	Slight	Slight	Slight	Northern red oak Yellow poplar	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
Upshur	3C	Severe	Severe	Slight	Slight	Northern red oak Yellow poplar Eastern white pine Virginia pine	65 80 80 66	3 5 10 7	Eastern white pine, Norway spruce, red pine, yellow poplar.
GnD**:									
Gilpin	4R	Moderate	Moderate	Slight	Slight	Northern red oak Yellow poplar	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
Upshur	3C	Severe	Severe	Slight	Slight	Northern red oak Yellow poplar Eastern white pine Virginia pine	65 80 80 66	3 5 10 7	Eastern white pine, Norway spruce, red pine, shortleaf pine, yellow poplar.
GoB**, GoC**:									
Gilpin	4A	Slight	Slight	Slight	Slight	Northern red oak Yellow poplar	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
Weikert	3D	Slight	Slight	Severe	Moderate	Northern red oak	60	3	Red pine, eastern white pine.
GoD**, GoF**:									
Gilpin	4R	Moderate	Moderate	Slight	Slight	Northern red oak Yellow poplar	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
Weikert	3D	Slight	Moderate	Severe	Moderate	Northern red oak	60	3	Eastern white pine, red pine, Virginia pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
GpC**:									
Gilpin	4A	Slight	Slight	Slight	Slight	Northern red oak	80	4	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
						Yellow poplar	95	7	
Wharton	4R	Moderate	Slight	Slight	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Norway spruce, Japanese larch, red pine.
						Yellow poplar	85	6	
GpD**:									
Gilpin	4R	Moderate	Moderate	Slight	Slight	Northern red oak	80	4	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
						Yellow poplar	95	7	
Wharton	4R	Severe	Moderate	Slight	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Norway spruce, Japanese larch, red pine.
						Yellow poplar	85	6	
GrA, GrB, GrC---Gresham	4W	Slight	Moderate	Moderate	Moderate	Northern red oak	80	4	Yellow poplar, eastern white pine, Japanese larch, Norway spruce, white spruce, black cherry.
						White ash	80	5	
						Yellow poplar	90	6	
						Black cherry	86	5	
						Sugar maple	80	4	
HaB, HaC, HbB---Hazleton	4F	Slight	Slight	Slight	Slight	Northern red oak	70	4	Japanese larch, eastern white pine, Norway spruce, red pine, yellow poplar, black cherry.
						Yellow poplar	80	5	
HaD, HaE---Hazleton	4F	Slight	Moderate	Slight	Slight	Northern red oak	70	4	Japanese larch, eastern white pine, Norway spruce, red pine, yellow poplar, black cherry.
						Yellow poplar	80	5	
HgD**:									
Hazleton	4F	Slight	Moderate	Slight	Slight	Northern red oak	70	4	Japanese larch, yellow poplar, eastern white, pine, Norway spruce, red pine, black cherry.
						Yellow poplar	80	5	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
HgD**:									
Gilpin	4R	Moderate	Moderate	Slight	Slight	Northern red oak	80	4	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
						Yellow poplar	95	7	
HgF**:									
Hazleton	3R	Moderate	Severe	Slight	Slight	Northern red oak	70	4	Japanese larch, yellow poplar, eastern white, pine, Norway spruce, red pine, black cherry.
						Yellow poplar	80	5	
Gilpin	4R	Severe	Severe	Slight	Slight	Northern red oak	80	4	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
						Yellow poplar	95	7	
MoB Monongahela	4A	Slight	Slight	Slight	Slight	Northern red oak	70	4	Eastern white pine, yellow poplar, Japanese larch, Norway spruce, red pine.
						Yellow poplar	85	6	
						White ash	---	---	
						Black walnut	---	---	
MoC Monongahela	4A	Moderate	Slight	Slight	Slight	Northern red oak	70	4	Eastern white pine, yellow poplar, Japanese larch, Norway spruce, red pine.
						Yellow poplar	85	6	
						White ash	---	9	
						Black walnut	---	7	
Ph Philo	5W	Slight	Moderate	Slight	Slight	Northern red oak	85	5	Yellow poplar, black walnut, eastern white pine, Japanese larch, Norway spruce, red pine.
						Yellow poplar	100	8	
						White oak	---	---	
						White ash	---	---	
Po Pope	5A	Slight	Slight	Slight	Slight	Northern red oak	85	5	Eastern white pine, yellow poplar, black walnut, Japanese larch, red oak.
						Yellow poplar	100	8	
						White ash	---	---	
						American sycamore	---	---	
						Northern red oak	---	---	
						American basswood	---	---	
RdB, RdC Riverhead	3A	Slight	Slight	Slight	Slight	Sugar maple	65	3	Eastern white pine, Norway spruce, Japanese larch.
						Northern red oak	80	4	
						Black cherry	---	---	
						Eastern white pine	---	---	
TaA, TaB Tilsit	4A	Slight	Slight	Slight	Slight	Northern red oak	70	4	Eastern white pine, Japanese larch, Norway spruce, black locust.
						Yellow poplar	85	6	
						White ash	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
TeB, TeC-------- Titusville	4D	Slight	Slight	Moderate	Moderate	Northern red oak---- Yellow poplar------- White ash---------- Black cherry--------	80 90 --- 85	4 6 --- 5	Yellow poplar, eastern white pine, Japanese larch, Norway spruce, red pine, red oak.
TrD**: Titusville-----	4R	Moderate	Moderate	Moderate	Moderate	Northern red oak---- Yellow poplar------- White ash---------- Black cherry--------	80 90 --- 85	4 4 6 5	Red pine, yellow poplar, eastern white pine, Japanese larch, Norway spruce, red oak.
Riverhead------	3R	Slight	Moderate	Slight	Slight	Sugar maple--------- Northern red oak---- Black cherry-------- Eastern white pine--	65 80 --- ---	3 4 --- ---	Eastern white pine, Norway spruce, Japanese larch.
UeB**: Urban land.									
Ernest---------	4W	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow poplar------- White ash---------- Sugar maple--------- Black cherry--------	75 80 71 69 74	4 5 3 3 3	Eastern white pine, Norway spruce, Japanese, larch, red oak, yellow poplar.
UeC**: Urban land.									
Ernest---------	4W	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow poplar------- White ash---------- Sugar maple--------- Black cherry--------	75 80 71 69 74	4 6 4 3 3	Eastern white pine, Norway spruce, Japanese larch, red oak, yellow poplar.
UgD**: Urban land.									
Gilpin---------	4R	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow poplar-------	80 95	4 7	Japanese larch, red pine, red oak, eastern white pine, yellow poplar, Norway spruce, black cherry.
VcB**: Vandergrift----	4W	Slight	Moderate	Moderate	Slight	Northern red oak---- Yellow poplar------- White ash----------	76 86 ---	4 6 ---	Eastern white pine, yellow poplar, Japanese larch, white spruce.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
VcB**:									
Cavode	4W	Slight	Moderate	Moderate	Moderate	Northern red oak	82	4	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, Japanese larch, red oak.
						Yellow poplar	95	7	
						White ash	---	---	
						Black cherry	---	---	
VcC**:									
Vandergrift	4W	Slight	Moderate	Moderate	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Japanese larch, white spruce.
						Yellow poplar	86	6	
						White ash	---	---	
Cavode	4W	Moderate	Moderate	Moderate	Moderate	Northern red oak	82	4	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, Japanese larch, red oak.
						Yellow poplar	95	7	
						White ash	---	---	
						Black cherry	---	---	
VcD**:									
Vandergrift	4W	Slight	Severe	Moderate	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Japanese larch, white spruce.
						Yellow poplar	86	6	
						White ash	---	---	
Cavode	4W	Severe	Moderate	Moderate	Moderate	Northern red oak	82	4	Eastern white pine, yellow poplar, black cherry, Norway spruce, white spruce, Japanese larch, red oak.
						Yellow poplar	95	7	
						White ash	---	---	
						Black cherry	---	---	
WaA, WaB	4A	Slight	Slight	Slight	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Japanese larch, Norway spruce, red pine.
Wharton						Yellow poplar	85	6	
WaC	4R	Moderate	Slight	Slight	Slight	Northern red oak	76	4	Eastern white pine, yellow poplar, Japanese larch, Norway spruce, red pine.
Wharton						Yellow poplar	85	6	
WhA, WhB	4A	Slight	Slight	Slight	Slight	Northern red oak	80	4	Eastern white pine, yellow poplar, black walnut, Japanese larch, Norway spruce, red oak.
Wheeling						Yellow poplar	90	6	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AnA, AnB---------- Andover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AnC---------- Andover	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
AoB---------- Andover	Severe: wetness.	Severe: wetness.	Severe: large stones, small stones.	Severe: wetness.	Severe: wetness.
AoC---------- Andover	Severe: wetness.	Severe: wetness.	Severe: large stones, slope, small stones.	Severe: wetness.	Severe: wetness.
Ar*: Arents. Urban land.					
At---------- Atkins	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
BeA, BeB, BeC---------- Braceville	Severe: wetness.	Severe: wetness.		Moderate: wetness.	Severe: wetness.
BrA, BrB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BrC---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
BuB---------- Buchanan	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Slight----------	Moderate: large stones.
BuC---------- Buchanan	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Slight----------	Moderate: large stones, slope.
BxB---------- Buchanan	Moderate: wetness, large stones.	Moderate: wetness, large stones.	Severe: large stones, small stones.	Slight----------	Severe: small stones.
BxD---------- Buchanan	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: large stones, slope, small stones.	Slight----------	Severe: small stones.
Cd---------- Canadice	Severe: ponding, percs slowly, excess humus.	Severe: ponding, percs slowly, excess humus.	Severe: excess humus, ponding, percs slowly.	Severe: ponding, excess humus, erodes easily.	Severe: ponding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CeA, CeB---------- Caneadea	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CeC---------- Caneadea	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
CeD---------- Caneadea	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: slope, wetness.
ClA, ClB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
ClC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
ClD---------- Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: slope, wetness.
CmB---------- Clymer	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
CoA---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: small stones.	Severe: erodes easily.	Moderate: wetness.
CoB---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: wetness.
CoC---------- Cookport	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.
CoD---------- Cookport	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Dd*, Dm*. Dumps					
ErB---------- Ernest	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: large stones, small stones.
ErC---------- Ernest	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, small stones, slope.
Fc. Fluvaquents					
FeA, FeB---------- Fredon	Severe: small stones, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FrA, FrB---------- Frenchtown	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
GlB---------- Gilpin	Slight----------	Slight----------	Moderate: small stones, slope.	Slight----------	Moderate: thin layer.
GlC---------- Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, thin layer.
GmD---------- Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
GnC*: Gilpin----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, thin layer.
Upshur----------	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
GnD*: Gilpin----------	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
Upshur----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GoB*: Gilpin----------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: large stones.	Moderate: thin layer, small stones.
Weikert----------	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: depth to rock, small stones.	Slight----------	Severe: thin layer, small stones.
GoC*: Gilpin----------	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Moderate: large stones.	Moderate: slope, small stones.
Weikert----------	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, depth to rock, small stones.	Slight----------	Severe: thin layer, small stones.
GoD*: Gilpin----------	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
Weikert----------	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, depth to rock, small stones.	Moderate: slope.	Severe: slope, thin layer, small stones.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GoF*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.	Severe: slope.
Weikert	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, thin layer, small stones.
GpC*:					
Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
Wharton	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, small stones.	Slight	Moderate: slope, wetness.
GpD*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
Wharton	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
GrA, GrB Gresham	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
GrC Gresham	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness, erodes easily.	Severe: wetness.
HaB Hazleton	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
HaC Hazleton	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Slight	Moderate: slope, small stones.
HaD Hazleton	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope.	Severe: slope.
HaE Hazleton	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.	Severe: slope.
HbB Hazleton	Moderate: large stones.	Moderate: large stones.	Severe: small stones, large stones.	Slight	Moderate: large stones.
HgD*:					
Hazleton	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HgD*: Gilpin	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Moderate: large stones, slope.	Severe: slope.
HgF*: Hazleton	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.	Severe: slope.
MoB Monongahela	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones.	Severe: erodes easily.	Slight.
MoC Monongahela	Moderate: wetness, slope.	Moderate: slope, wetness.	Slope	Severe: erodes easily.	Moderate: slope.
Ph Philo	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Pn*. Pits					
Po Pope	Severe: flooding.	Slight	Moderate: small stones, flooding.	Severe: erodes easily.	Moderate: flooding.
RdB Riverhead	Slight	Slight	Moderate: slope.	Slight	Slight.
RdC Riverhead	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
TaA Tilsit	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.
TaB Tilsit	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
TeB Titusville	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
TeC Titusville	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TrD*:					
Titusville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Riverhead	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
UaB, UaD, UaF, UcD, UcF. Udorthents					
UeB*: Urban land.					
Ernest	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: large stones, small stones.
UeC*: Urban land.					
Ernest	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, small stones, slope.
UgD*: Urban land.					
Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
VcB*:					
Vandergrift	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
VcC*:					
Vandergrift	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
Cavode	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
VcD*:					
Vandergrift	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness, slope.
Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: slope, wetness.
WaA	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Slight	Moderate: wetness.
Wharton					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WaB---------- Wharton	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, percs slowly, wetness.	Slight----------	Moderate: wetness.
WaC---------- Wharton	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, small stones.	Slight----------	Moderate: slope, wetness.
WhA---------- Wheeling	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
WhB---------- Wheeling	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AnA---- Andover	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
AnB---- Andover	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
AnC---- Andover	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
AoB---- Andover	Very poor.	Poor	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
AoC---- Andover	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Ar*: Arents.										
Urban land.										
At---- Atkins	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
BeA---- Braceville	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
BeB---- Braceville	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
BeC---- Braceville	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
BrA---- Brinkerton	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
BrB---- Brinkerton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
BrC---- Brinkerton	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
BuB---- Buchanan	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BuC---- Buchanan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BxB---- Buchanan	Very poor.	Poor	Good	Good	Good	Fair	Very poor.	Poor	Good	Poor.
BxD---- Buchanan	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
Cd---- Canadice	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CeA---- Caneadea	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CeB---- Caneadea	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CeC---- Caneadea	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CeD---- Caneadea	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ClA---- Cavode	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
ClB---- Cavode	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ClC---- Cavode	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ClD---- Cavode	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CmB---- Clymer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoA---- Cookport	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CoB---- Cookport	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoC---- Cookport	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CoD---- Cookport	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Dd*, Dm*. Dumps										
ErB---- Ernest	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ErC---- Ernest	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fc. Fluvaquents										
FeA---- Fredon	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
FeB---- Fredon	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
FrA, FrB---- Frenchtown	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GlB---------- Gilpin	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
GlC---------- Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
GmD---------- Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GnC*:										
Gilpin----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Upshur----------	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GnD*:										
Gilpin----------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur----------	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GoB*:										
Gilpin----------	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Weikert----------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
GoC*:										
Gilpin----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Weikert----------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
GoD*:										
Gilpin----------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Weikert----------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
GoF*:										
Gilpin----------	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Weikert----------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
GpC*:										
Gilpin----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Wharton----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GpD*:										
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Wharton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GrA Gresham	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
GrB Gresham	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GrC Gresham	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HaB Hazleton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HaC Hazleton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HaD Hazleton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
HaE Hazleton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
HbB Hazleton	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
HgD*:										
Hazleton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
HgF*:										
Hazleton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
MoB Monongahela	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MoC Monongahela	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ph Philo	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Pn*. Pits										
Po Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
RdB, RdC---------- Riverhead	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TaA---------- Tilsit	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
TaB---------- Tilsit	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TeB---------- Titusville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TeC---------- Titusville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TrD*:										
Titusville--------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Riverhead---------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
UaB, UaD, UaF, UcD, UcF. Udorthents										
UeB*:										
Urban land.										
Ernest----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UeC*:										
Urban land.										
Ernest----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
UgD*:										
Urban land.										
Gilpin----------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
VcB*:										
Vandergrift-------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Cavode----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
VcC*:										
Vandergrift-------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Cavode----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
VcD*:										
Vandergrift	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cavode	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WaA---- Wharton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
WaB---- Wharton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WaC---- Wharton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WhA---- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhB---- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AnA, AnB---------- Andover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
AnC---------- Andover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness, frost action.	Severe: wetness.
AoB---------- Andover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
AoC---------- Andover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness, frost action.	Severe: wetness.
Ar*: Arents.						
Urban land.						
At---------- Atkins	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, frost action.	Severe: wetness, flooding.
BeA, BeB---------- Braceville	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BeC---------- Braceville	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
BrA, BrB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
BrC---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
BuB---------- Buchanan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness, frost action.	Moderate: large stones.
BuC---------- Buchanan	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness, frost action.	Moderate: large stones, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BxB---------- Buchanan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Severe: small stones.
BxD---------- Buchanan	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Severe: small stones.
Cd---------- Canadice	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
CeA, CeB---------- Caneadea	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
CeC---------- Caneadea	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: slope, wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Severe: wetness.
CeD---------- Caneadea	Severe: slope, wetness.	Severe: slope, wetness, shrink-swell.	Severe: slope, wetness, shrink-swell.	Severe: slope, wetness, shrink-swell.	Severe: slope, low strength, frost action.	Severe: slope, wetness.
ClA, ClB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
ClC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
ClD---------- Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness, low strength.	Severe: slope, wetness.
CmB---------- Clymer	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Slight.
CoA---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CoB---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CoC---------- Cookport	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness, low strength.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CoD---------- Cookport	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Severe: slope.
Dd*, Dm*. Dumps						
ErB---------- Ernest	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: large stones, small stones.
ErC---------- Ernest	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: large stones, small stones, slope.
Fc. Fluvaquents						
FeA, FeB---------- Fredon	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
FrA, FrB---------- Frenchtown	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
GlB---------- Gilpin	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
GlC---------- Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
GmD---------- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GnC*: Gilpin----------	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Upshur----------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, low strength.	Moderate: slope.
GnD*: Gilpin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur----------	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope.
GoB*: Gilpin----------	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer, small stones.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GoB*:						
Weikert	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Severe: thin layer, small stones.
GoC*:						
Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
Weikert	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Severe: thin layer, small stones.
GoD*, GoF*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Weikert	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer, small stones.
GpC*:						
Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Wharton	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope, wetness.
GpD*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wharton	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope, frost action, low strength.	Severe: slope.
GrA, GrB Gresham	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
GrC Gresham	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness, frost action, low strength.	Severe: wetness.
HaB Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, droughty.
HaC Hazleton	Moderate: depth to rock, slope, large stones.	Moderate: slope, large stones.	Moderate: slope, large stones, depth to rock.	Severe: slope.	Moderate: slope, frost action, large stones.	Moderate: slope, small stones.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
HaD, HaE---------- Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HbB---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: large stones.
HgD*, HgF*: Hazleton----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MoB---------- Monongahela	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: low strength, wetness.	Slight.
MoC---------- Monongahela	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: slope, low strength, wetness.	Moderate: slope.
Ph---------- Philo	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Pn*. Pits						
Po---------- Pope	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
RdB---------- Riverhead	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
RdC---------- Riverhead	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
TaA---------- Tilsit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Moderate: wetness.
TaB---------- Tilsit	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength.	Moderate: wetness.
TeB---------- Titusville	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Moderate: wetness.
TeC---------- Titusville	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: wetness, slope.
TrD*: Titusville--------	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TrD*:						
Riverhead	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
UaB, UaD, UaF, UcD, UcF. Udorthents						
UeB*:						
Urban land.						
Ernest	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: large stones, small stones.
UeC*:						
Urban land.						
Ernest	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: large stones, small stones, slope.
UgD*:						
Urban land.						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VcB*:						
Vandergrift	Severe: wetness, slippage.	Severe: wetness, shrink-swell, slippage.	Severe: wetness, shrink-swell, slippage.	Severe: wetness, shrink-swell, slippage.	Severe: low strength, wetness, slippage.	Severe: wetness.
Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
VcC*:						
Vandergrift	Severe: wetness, slippage.	Severe: wetness, shrink-swell, slippage.	Severe: wetness, shrink-swell, slippage.	Severe: wetness, shrink-swell, slope.	Severe: low strength, wetness, slippage.	Severe: wetness.
Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
VcD*:						
Vandergrift	Severe: wetness, slope, slippage.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, wetness, slope.	Severe: wetness, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VcD*: Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness, low strength.	Severe: slope, wetness.
WaA Wharton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
WaB Wharton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
WaC Wharton	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope, wetness.
WhA Wheeling	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.	Slight.
WhB Wheeling	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AnA, AnB---------- Andover	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AnC---------- Andover	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AoB---------- Andover	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AoC---------- Andover	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ar*: Arents. Urban land.					
At---------- Atkins	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Poor: wetness.
BeA, BeB---------- Braceville	Severe: percs slowly, wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: seepage, too sandy, small stones.
BeC---------- Braceville	Severe: percs slowly, wetness, poor filter.	Severe: slope, seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: seepage, too sandy, small stones.
BrA---------- Brinkerton	Severe: wetness, percs slowly.	Slight----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
BrB---------- Brinkerton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BrC---------- Brinkerton	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BuB---------- Buchanan	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
BuC---------- Buchanan	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: slope, wetness.	Poor: small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BxB---------- Buchanan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
BxD---------- Buchanan	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Moderate: slope, wetness.	Poor: small stones.
Cd---------- Canadice	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
CeA, CeB---------- Caneadea	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
CeC---------- Caneadea	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
CeD---------- Caneadea	Severe: slope, wetness, percs slowly.	Severe: slope.	Severe: slope, wetness, too clayey.	Severe: slope, wetness.	Poor: slope, too clayey, hard to pack.
ClA---------- Cavode	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
ClB---------- Cavode	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
ClC---------- Cavode	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
ClD---------- Cavode	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness, slope.	Severe: slope, wetness.	Poor: slope, too clayey, wetness.
CmB---------- Clymer	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: small stones.
CoA, CoB---------- Cookport	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, too clayey, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CoC---------- Cookport	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, depth to rock.	Moderate: slope, wetness, depth to rock.	Fair: area reclaim, wetness, slope.
CoD---------- Cookport	Severe: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: slope, wetness, depth to rock.	Severe: slope.	Poor: slope.
Dd*, Dm*. Dumps					
ErB---------- Ernest	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
ErC---------- Ernest	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: slope, wetness.	Poor: small stones.
Fc. Fluvaquents					
FeA, FeB---------- Fredon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
FrA---------- Frenchtown	Severe: ponding, percs slowly.	Slight----------	Severe: ponding.	Severe: ponding.	Poor: ponding.
FrB---------- Frenchtown	Severe: ponding, percs slowly.	Slight----------	Severe: ponding.	Severe: ponding.	Poor: ponding.
GlB---------- Gilpin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GlC---------- Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GmD---------- Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
GnC*: Gilpin----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Upshur----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GnD*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Upshur	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.
GoB*:					
Gilpin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Weikert	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim, seepage, small stones.
GoC*:					
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Weikert	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim, seepage, small stones.
GoD*, GoF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Weikert	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, area reclaim, seepage.
GpC*:					
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Wharton	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: slope, too clayey.
GpD*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Wharton	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GrA, GrB---------- Gresham	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
GrC---------- Gresham	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
HaB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HaC---------- Hazleton	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HaD, HaE---------- Hazleton	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
HbB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HgD*, HgF*: Hazleton----------	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
Gilpin----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim, large stones.
MoB---------- Monongahela	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: small stones, wetness.
MoC---------- Monongahela	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: slope, wetness.	Fair: small stones, wetness, slope.
Ph---------- Philo	Severe: flooding, wetness, poor filter.	Severe: flooding, wetness, seepage.	Severe: flooding, depth to rock, seepage.	Severe: flooding, wetness.	Fair: area reclaim, wetness, thin layer.
Pn*. Pits					
Po---------- Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
RdB---------- Riverhead	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RdC---------- Riverhead	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
TaA, TaB---------- Tilsit	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Moderate: wetness, depth to rock.	Fair: area reclaim, too clayey.
TeB---------- Titusville	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, small stones.
TeC---------- Titusville	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, small stones, slope.
TrD*: Titusville---------	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Poor: slope.
Riverhead----------	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope.	Severe: slope, seepage.	Poor: seepage, too sandy, slope.
UaB, UaD, UaF, UcD, UcF. Udorthents					
UeB*: Urban land.					
Ernest----------	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
UeC*: Urban land.					
Ernest----------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: slope, wetness.	Moderate: slope, wetness.	Poor: small stones.
UgD*: Urban land.					
Gilpin----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
VcB*: Vandergrift---------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness, slippage.	Severe: wetness.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VcB*: Cavode	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
VcC*: Vandergrift	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: depth to rock, wetness, slippage.	Severe: wetness.	Poor: too clayey, hard to pack.
Cavode	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
VcD*: Vandergrift	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: depth to rock, wetness, slope.	Severe: wetness, slope.	Poor: too clayey, hard to pack, slope.
Cavode	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness, slope.	Severe: slope, wetness.	Poor: slope, too clayey, wetness.
WaA Wharton	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
WaB Wharton	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
WaC Wharton	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: slope, too clayey.
WhA, WhB Wheeling	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AnA, AnB, AnC, AoB, AoC---------- Andover	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
Ar*: Arents. Urban land.				
At---------- Atkins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BeA, BeB, BeC---------- Braceville	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
BrA, BrB, BrC---------- Brinkerton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BuB, BuC, BxB, BxD---- Buchanan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cd---------- Canadice	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
CeA, CeB---------- Caneadea	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CeC---------- Caneadea	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
CeD---------- Caneadea	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer, wetness.
ClA, ClB, ClC---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
ClD---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CmB---------- Clymer	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
CoA, CoB, CoC---------- Cookport	Fair: low strength, wetness, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
CoD---------- Cookport	Fair: slope, wetness, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Dd*, Dm*. Dumps				
ErB, ErC---------- Ernest	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Fc. Fluvaquents				
FeA, FeB---------- Fredon	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
FrA, FrB---------- Frenchtown	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
GlB, GlC---------- Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GmD---------- Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GnC*: Gilpin----------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Upshur----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GnD*: Gilpin----------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GoB*, GoC*: Gilpin----------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GoB*, GoC*:				
Weikert	Poor: area reclaim.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, area reclaim.
GoD*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Weikert	Poor: area reclaim.	Improbable: small stones.	Improbable: thin layer.	Poor: slope, small stones, area reclaim.
GoF*:				
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Weikert	Poor: slope, area reclaim.	Improbable: small stones.	Improbable: thin layer.	Poor: slope, small stones, area reclaim.
GpC*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
GpD*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, area reclaim.
GrA, GrB, GrC Gresham	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
HaB, HaC Hazleton	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HaD Hazleton	Fair: slope, area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
HaE Hazleton	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HbB---------- Hazleton	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HgD*: Hazleton----------	Fair: slope, area reclaim, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Gilpin----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, large stones, small stones.
HgF*: Hazleton----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Gilpin----------	Poor: slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, large stones, small stones.
MoB---------- Monongahela	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MoC---------- Monongahela	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Ph---------- Philo	Fair: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Pn*. Pits				
Po---------- Pope	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
RdB, RdC---------- Riverhead	Good----------	Probable----------	Probable----------	Poor: small stones.
TaA, TaB---------- Tilsit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
TeB---------- Titusville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
TeC---------- Titusville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TrD*:				
Titusville	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Riverhead	Fair: slope.	Probable	Probable	Poor: small stones, slope.
UaB, UaD, UaF, UcD, UcF. Udorthents				
UeB*, UeC*: Urban land.				
Ernest	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
UgD*: Urban land.				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
VcB*, VcC*:				
Vandergrift	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
VcD*:				
Vandergrift	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, slope, too clayey.
Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness, slope.
WaA, WaB, WaC Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
WhA, WhB Wheeling	Fair: low strength.	Probable	Probable	Fair: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AnA---------- Andover	Slight---------	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Rooting depth	Wetness, rooting depth, percs slowly.
AnB---------- Andover	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Rooting depth	Wetness, rooting depth, percs slowly.
AnC---------- Andover	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, rooting depth.	Wetness, slope, rooting depth.
AoB---------- Andover	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Large stones, wetness, rooting depth.	Large stones, wetness, rooting depth.
AoC---------- Andover	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, large stones, wetness.	Large stones, wetness, slope.
Ar*: Arents.						
Urban land.						
At---------- Atkins	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
BeA---------- Braceville	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Percs slowly---	Wetness, rooting depth, percs slowly.	Percs slowly, wetness, droughty.
BeB---------- Braceville	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, percs slowly.	Percs slowly, wetness, droughty.
BeC---------- Braceville	Severe: seepage, slope.	Severe: seepage, wetness.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, slope.	Percs slowly, droughty, slope.
BrA---------- Brinkerton	Slight---------	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
BrB---------- Brinkerton	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
BrC---------- Brinkerton	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
BuB---------- Buchanan	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Percs slowly, rooting depth.	Percs slowly, rooting depth.
BuC---------- Buchanan	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, percs slowly, rooting depth.	Slope, percs slowly, rooting depth.
BxB---------- Buchanan	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Percs slowly, rooting depth.	Percs slowly, rooting depth.
BxD---------- Buchanan	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, percs slowly, rooting depth.	Slope, percs slowly, rooting depth.
Cd---------- Canadice	Slight---------	Severe: hard to pack, ponding.	Severe: slow refill.	Percs slowly, ponding.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, rooting depth.
CeA---------- Caneadea	Slight---------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
CeB---------- Caneadea	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
CeC, CeD---------- Caneadea	Severe: slope.	Severe: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, wetness, erodes easily.
ClA---------- Cavode	Moderate: depth to rock.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
ClB---------- Cavode	Moderate: depth to rock, slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
ClC, ClD---------- Cavode	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.
CmB---------- Clymer	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Large stones---	Large stones.
CoA---------- Cookport	Moderate: depth to rock.	Severe: piping.	Severe: no water.	Percs slowly---	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
CoB---------- Cookport	Moderate: depth to rock, slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
CoC, CoD---------- Cookport	Severe: slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Dd*, Dm*. Dumps						
ErB---------- Ernest	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, rooting depth, percs slowly.	Erodes easily, rooting depth.
ErC---------- Ernest	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, rooting depth.	Rooting depth, slope, erodes easily.
Fc. Fluvaquents						
FeA---------- Fredon	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, too sandy.	Wetness.
FeB---------- Fredon	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, slope.	Wetness, too sandy.	Wetness.
FrA, FrB---------- Frenchtown	Slight---------	Severe: piping, ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Erodes easily, ponding, rooting depth.	Wetness, erodes easily, rooting depth.
GlB---------- Gilpin	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, large stones.	Depth to rock, large stones.
GlC, GmD---------- Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
GnC*, GnD*: Gilpin----------	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Upshur----------	Severe: slope, slippage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
GoB*: Gilpin----------	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, large stones.	Depth to rock, large stones.
Weikert----------	Severe: depth to rock, seepage.	Severe: seepage, thin layer.	Severe: no water.	Deep to water	Depth to rock	Droughty, depth to rock.
GoC*, GoD*, GoF*: Gilpin----------	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
GoC*, GoD*, GoF*: Weikert	Severe: depth to rock, slope, seepage.	Severe: seepage, thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, droughty.
GpC*, GpD*: Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Wharton	Severe: slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, slope, percs slowly.	Slope, percs slowly.
GrA Gresham	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
GrB Gresham	Moderate: seepage, slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
GrC Gresham	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
HaB Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HaC, HaD, HaE Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, too sandy.	Large stones, slope, droughty.
HbB Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HgD*, HgF*: Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, slope, too sandy.	Large stones, slope, droughty.
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
MoB Monongahela	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth, percs slowly.
MoC Monongahela	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Ph Philo	Severe: seepage.	Severe: piping.	Moderate: deep to water.	Flooding	Wetness	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Pn*. Pits						
Po---------- Pope	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
RdB---------- Riverhead	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Favorable.
RdC---------- Riverhead	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, too sandy.	Slope.
TaA---------- Tilsit	Moderate: depth to rock, seepage.	Severe: piping.	Severe: no water.	Percs slowly---	Erodes easily, wetness.	Erodes easily, rooting depth.
TaB---------- Tilsit	Moderate: depth to rock, seepage.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
TeB---------- Titusville	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
TeC---------- Titusville	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
TrD*: Titusville--------	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Riverhead--------	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, too sandy.	Slope.
UaB, UaD, UaF, UcD, UcF. Udorthents						
UeB*: Urban land.						
Ernest----------	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, rooting depth, percs slowly.	Erodes easily, rooting depth.
UeC*: Urban land.						
Ernest----------	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, rooting depth.	Rooting depth, slope, erodes easily.
UgD*: Urban land.						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
UgD*:						
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
VcB*:						
Vandergrift	Moderate: depth to rock, slope, slippage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, slippage.	Wetness, percs slowly.
Cavode	Moderate: depth to rock, slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
VcC*, VcD*:						
Vandergrift	Severe: slope, slippage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
Cavode	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.
WaA	Moderate: depth to rock.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly.
Wharton						
WaB	Moderate: depth to rock, slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Percs slowly.
Wharton						
WaC	Severe: slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, slope, percs slowly.	Slope, percs slowly.
Wharton						
WhA	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
Wheeling						
WhB	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
Wheeling						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AnA, AnB, AnC---- Andover	0-10	Loam----------	ML, SM, CL-ML	A-4	0-5	85-100	80-95	60-90	35-85	20-35	NP-10
	10-21	Loam, gravelly clay loam, cobbly sandy clay loam.	SM, ML, CL-ML, CL	A-4, A-2	0-20	80-95	65-85	60-85	30-60	20-35	2-10
	21-42	Loam, gravelly clay loam, cobbly sandy clay loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0-20	80-95	65-85	60-85	30-60	20-35	2-9
	42-62	Gravelly sandy clay loam, cobbly loam, cobbly sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	5-30	70-95	55-90	50-75	25-60	20-35	2-9
AoB, AoC---------- Andover	0-10	Very stony loam	ML, CL, SM, SC	A-4, A-2	3-10	70-100	65-95	60-90	30-85	20-35	NP-10
	10-21	Loam, gravelly clay loam, cobbly sandy clay loam.	SM, SC, ML, CL	A-4, A-2	0-25	80-95	65-85	60-80	30-60	20-35	2-10
	21-42	Loam, gravelly clay loam, cobbly sandy clay loam.	SM, ML, SM-SC, CL-ML	A-4, A-2	0-25	80-95	65-85	60-85	30-60	20-35	2-9
	42-62	Gravelly sandy clay loam, cobbly loam, cobbly sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	5-30	70-95	55-90	50-75	25-60	20-35	2-9
Ar*: Arents.											
Urban land.											
At---------- Atkins	0-11	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-95	20-40	3-20
	11-47	Silty clay loam, silt loam, sandy loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	65-100	45-85	20-40	3-20
	47-65	Stratified silty clay loam to gravelly sandy loam.	SM, CL, GM, ML	A-2, A-4, A-6	0-15	60-100	60-100	50-95	30-85	20-40	1-15
BeA, BeB, BeC---- Braceville	0-8	Loam----------	ML, CL, SM	A-4, A-2	0-15	95-100	80-100	75-100	30-90	15-30	NP-10
	8-17	Gravelly sandy loam, silt loam, gravelly loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	60-100	40-100	20-90	15-35	NP-10
	17-33	Gravelly sandy loam, gravelly silt loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	40-75	25-75	15-65	15-35	NP-10
	33-72	Stratified sand and gravel.	GM, SM, GW-GM, GP-GM	A-1, A-2, A-4	0-15	40-100	35-100	25-90	10-50	<30	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BrA, BrB, BrC---- Brinkerton	0-9	Silt loam--------	ML	A-4, A-6	0-10	90-100	85-100	85-100	75-100	---	---
	9-20	Silty clay loam, silt loam.	ML	A-4, A-6, A-7, A-5	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	20-48	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7, A-5	0-10	75-100	60-100	60-100	55-100	30-45	5-15
	48-60	Silt loam, shaly loam, channery silt loam.	ML, SM, SC, CL	A-4, A-6, A-2, A-1	0-50	70-90	25-85	25-85	20-75	30-40	5-15
BuB, BuC--------- Buchanan	0-6	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-100	85-100	75-90	65-85	20-35	2-11
	6-29	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM	A-4, A-2	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	29-64	Gravelly loam, loam, channery clay loam.	GM, ML, CL, SM	A-4, A-2, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15
BxB, BxD--------- Buchanan	0-6	Very stony loam	GM, ML, CL, CL-ML	A-2, A-4	3-20	50-90	45-75	40-75	30-65	20-35	2-11
	6-29	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM	A-2, A-4	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	29-64	Gravelly loam, loam, channery clay loam.	GM, ML, CL, SM	A-2, A-4, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15
Cd--------------- Canadice	0-11	Silty clay loam	ML, MH, OL, OH	A-7	0	100	95-100	85-100	65-95	40-65	10-25
	11-53	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-95	45-65	20-30
	53-80	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-95	45-65	20-30
CeA, CeB--------- Caneadea	0-8	Silt loam--------	CL	A-7, A-6	0	100	90-100	90-100	75-95	30-45	10-24
	8-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	85-100	40-60	18-34
CeC, CeD--------- Caneadea	0-8	Silt loam--------	CL	A-7, A-6	0	100	90-100	90-100	75-95	30-45	10-24
	8-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	85-100	40-60	18-34
ClA, ClB, ClC, ClD---------- Cavode	0-10	Silt loam--------	ML, CL	A-4	0-5	90-100	80-100	80-95	75-95	---	---
	10-45	Silty clay loam, silty clay, clay.	ML, CL, CL-ML	A-4, A-7, A-6	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	45-60	Shaly silty clay loam, silty clay, clay.	ML, CL, GC, GM	A-2, A-4, A-6	0-45	50-100	35-100	30-80	25-75	25-45	2-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CmB---------- Clymer	0-8	Loam----------	ML, SM	A-4	0-5	85-100	75-95	60-90	35-85	10-30	NP-9
	8-38	Sandy loam, channery loam, channery clay loam.	GM, SM, GC, ML	A-2, A-4	0-20	60-95	50-95	45-85	30-60	14-32	NP-9
	38-44	Channery loam, very channery loam, channery sandy loam.	GM, GP-GM, GC, SM	A-1, A-2, A-3, A-4	10-30	30-75	25-70	20-60	5-40	14-32	NP-9
	44-48	Weathered bedrock	---	---	---	---	---	---	---	---	---
CoA, CoB, CoC, CoD---------- Cookport	0-9	Loam----------	ML, CL, SM, SC	A-2, A-4, A-6	0-5	85-100	80-100	60-85	30-85	20-40	1-15
	9-24	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	24-39	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	39-60	Very channery sandy loam, channery loam.	ML, CL, SM-SC, GM-GC	A-2, A-4, A-6	0-15	60-100	50-95	40-95	30-75	20-40	1-15
Dd*, Dm*. Dumps											
ErB, ErC---------- Ernest	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-95	60-95	20-40	4-15
	8-23	Silty clay loam, silt loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-15	75-95	70-100	65-90	55-90	25-50	6-22
	23-55	Channery silt loam, channery loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	55-60	Channery silt loam, silt loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	45-95	45-90	40-90	25-50	6-22
Fc. Fluvaquents											
FeA, FeB---------- Fredon	0-10	Loam----------	ML, CL, SC, SM	A-2, A-4, A-1	0-2	80-100	75-95	30-90	15-70	20-30	NP-10
	10-30	Loam, silt loam, gravelly sandy loam.	SM, GC, ML, CL	A-2, A-4, A-1	0-2	60-100	50-95	30-85	15-70	20-30	NP-10
	30-60	Stratified very gravelly sand to loamy fine sand.	GP, GM, GW, GW-GM	A-1, A-2	0-5	30-90	25-85	10-60	0-35	---	NP
FrA, FrB---------- Frenchtown	0-12	Silt loam--------	CL-ML, ML, CL	A-4, A-6	0	90-100	85-100	80-90	70-85	22-35	3-12
	12-17	Silt loam, loam, gravelly clay loam.	CL, CL-ML	A-6, A-4	0	85-100	75-100	70-95	55-80	25-40	4-15
	17-65	Loam, silt loam, gravelly clay loam.	CL, CL-ML, SC, GC	A-6, A-4	0	60-100	45-95	40-90	35-70	20-35	4-12

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GlB, GlC--------- Gilpin	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
GmD-------------- Gilpin	0-8	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
GnC*: Gilpin----------	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Upshur----------	0-6	Silty clay loam	CL, ML	A-6, A-7	0	95-100	95-100	90-100	80-95	35-50	11-25
	6-34	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	34-77	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25
	77-81	Weathered bedrock	---	---	---	---	---	---	---	---	---
GnD*: Gilpin----------	0-8	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GnD*:											
Upshur----------	0-6	Silty clay loam	CL, ML	A-6, A-7	0	95-100	95-100	90-100	80-95	35-50	11-25
	6-34	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	34-77	Silty clay loam, silty clay, clay.	CL, ML, MH, CH	A-6, A-7	0	80-100	65-100	60-100	55-95	35-55	11-25
	77-81	Weathered bedrock	---	---	---	---	---	---	---	---	---
GoB*, GoC*, GoD*, GoF*:											
Gilpin----------	0-8	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Weikert---------	0-6	Channery silt loam.	GM, ML, SM	A-1, A-2, A-4	0-10	35-70	35-70	25-65	20-55	30-40	4-10
	6-16	Shaly loam, very shaly silt loam, cherty loam.	GM, GP-GM	A-1, A-2	0-20	15-60	10-55	5-45	5-35	28-36	3-9
	16-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
GpC*:											
Gilpin----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wharton----------	0-9	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	90-100	80-95	70-90	---	---
	9-46	Clay loam, shaly silty clay loam, shaly silt loam.	ML, CL	A-7, A-6	0-25	75-100	70-100	65-95	60-90	35-45	10-25
	46-69	Silt loam, shaly clay, very shaly silt loam.	ML, GM, SM	A-4, A-6, A-7, A-2	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	69-73	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GpD*:											
Gilpin----------	0-8	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wharton---------	0-9	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	90-100	80-95	70-90	---	---
	9-46	Clay loam, shaly silty clay loam, shaly silt loam.	ML, CL	A-7, A-6	0-25	75-100	70-100	65-95	60-90	35-45	10-25
	46-69	Silt loam, shaly clay, very shaly silt loam.	ML, GM, SM	A-4, A-6, A-7, A-2	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	69-73	Weathered bedrock	---	---	---	---	---	---	---	---	---
GrA, GrB, GrC----	0-8	Silt loam--------	ML, CL-ML	A-4	0-1	95-100	90-100	85-95	70-90	25-35	4-10
Gresham	8-21	Loam, silt loam, clay loam.	CL, ML	A-6, A-4, A-7	0-1	95-100	80-100	75-95	65-85	30-45	8-20
	21-67	Clay loam, silt loam, loam.	CL, CL-ML, ML	A-6, A-4, A-7	0-2	95-100	80-100	75-95	65-85	20-45	6-22
	67-75	Gravelly clay loam, silt loam, channery loam.	CL, CL-ML, ML	A-4, A-6	0-5	70-100	50-95	45-90	40-75	20-40	6-18
HaB, HaC, HaD, HaE----------	0-7	Channery loam----	ML, GM, SM	A-2, A-4	0-15	60-85	60-80	60-75	35-55	---	---
Hazleton	7-34	Channery sandy loam, loam, very channery loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	34-84	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	0-60	55-80	35-75	25-65	15-50	<30	NP-8
	84-88	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HbB----------	0-7	Very stony loam	ML, GM, SM	A-4, A-2	5-15	60-85	50-80	50-70	35-55	---	---
Hazleton	7-34	Channery sandy loam, channery loam, loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	34-84	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	5-60	50-80	35-75	25-65	15-50	<30	NP-8
	84-88	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HgD*, HgF*:											
Hazleton	0-7	Very stony loam	ML, GM, SM	A-4, A-2	5-15	60-85	50-80	50-70	35-55	---	---
	7-34	Channery sandy loam, channery loam, loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	34-84	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	5-60	50-80	35-75	25-65	15-50	<30	NP-8
	84-88	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilpin	0-8	Very stony silt loam.	GC, CL, SC, CL-ML	A-2, A-4, A-6	10-40	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Shaly silt loam, channery loam, silty clay loam.	GM-GC, CL, CL-ML, SC	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
MoB, MoC Monongahela	0-9	Silt loam	ML, SM, CL-ML, SM-SC	A-4	0-5	90-100	85-100	75-100	45-90	20-35	1-10
	9-20	Silt loam, clay loam, gravelly loam.	ML, CL, CL-ML	A-4, A-6	0-15	90-100	80-100	75-100	70-90	20-40	5-15
	20-40	Silt loam, sandy clay loam, gravelly loam.	ML, CL, SM, SC	A-4, A-6	0-10	80-100	60-100	55-95	45-95	20-40	3-15
	40-60	Silt loam, clay loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	10-20	75-100	60-90	60-85	40-85	20-40	1-15
Ph Philo	0-10	Loam	ML, SM, CL-ML	A-4	0-5	95-100	80-100	85-90	60-80	20-35	1-10
	10-46	Silt loam, loam, sandy loam.	ML, SM, CL-ML	A-4	0-5	95-100	75-100	70-90	45-80	20-35	1-10
	46-60	Stratified sand to silt loam.	GM, SM, ML, CL-ML	A-2, A-4	0-5	60-95	50-90	40-85	30-80	15-30	1-10
Pn*. Pits											
Po Pope	0-7	Loam	ML, CL, SM, CL-ML	A-4	0	85-100	75-100	70-100	45-90	<30	NP-10
	7-45	Fine sandy loam, sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
	45-80	Sandy loam, loamy sand.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RdB, RdC--------- Riverhead	0-10	Sandy loam--------	SM, ML	A-2, A-4	0-5	95-100	90-100	55-95	30-75	14-18	1-3
	10-20	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, GM	A-2, A-4, A-1	0-5	65-100	60-95	40-80	20-45	14-18	1-3
	20-27	Loamy sand, gravelly loamy sand, fine sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0-5	60-90	55-85	30-70	10-45	---	NP
	27-60	Stratified sand and gravel.	SP, SW, SP-SM	A-1	0-5	60-95	55-90	25-50	0-10	---	NP
TaA, TaB--------- Tilsit	0-11	Silt loam---------	CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-100	20-35	4-15
	11-25	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	65-100	25-40	5-20
	25-55	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	85-100	75-100	65-100	25-45	5-25
	55-60	Channery silt loam, very channery silt loam, silt loam, silty clay loam, silty clay.	CL, CH, CL-ML	A-4, A-6, A-7	0-30	70-100	65-85	60-85	55-80	25-60	5-35
TeB, TeC--------- Titusville	0-9	Silt loam---------	ML, CL, CL-ML	A-4	0-1	95-100	95-100	80-95	75-90	20-35	2-10
	9-23	Loam, silt loam, clay loam.	CL, ML	A-6, A-4, A-7	0-2	95-100	95-100	80-95	70-85	30-45	8-20
	23-60	Silt loam, clay loam, gravelly loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-95	65-80	55-70	20-35	6-18
TrD*: Titusville------	0-9	Silt loam---------	ML, CL, CL-ML	A-4	0-1	95-100	95-100	80-95	75-90	20-35	2-10
	9-23	Loam, silt loam, clay loam.	CL, ML	A-6, A-4, A-7	0-2	95-100	95-100	80-95	70-85	30-45	8-20
	23-60	Silt loam, clay loam, gravelly loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-95	65-80	55-70	20-35	6-18
Riverhead--------	0-10	Sandy loam--------	SM, ML	A-2, A-4	0-5	95-100	90-100	55-95	30-75	14-18	1-3
	10-20	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, GM	A-2, A-4, A-1	0-5	65-100	60-95	40-80	20-45	14-18	1-3
	20-27	Loamy sand, gravelly loamy sand, fine sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0-5	60-90	55-85	30-70	10-45	---	NP
	27-60	Stratified sand and gravel.	SP, SW, SP-SM	A-1	0-5	60-95	55-90	25-50	0-10	---	NP
UaB, UaD, UaF, UcD, UcF. Udorthents											
UeB*, UeC*: Urban land.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
UeB*, UeC*:											
Ernest----------	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-95	60-95	20-40	4-15
	8-23	Silty clay loam, silt loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-15	75-95	70-100	65-90	55-90	25-50	6-22
	23-55	Channery silt loam, channery loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	55-60	Channery silt loam, silt loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	45-95	45-90	40-90	25-50	6-22
UgD*:											
Urban land.											
Gilpin----------	0-8	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	8-30	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	30-36	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
VcB*, VcC*, VcD*:											
Vandergrift-----	0-7	Silt loam--------	CL	A-4, A-6	0	95-100	90-100	85-100	80-90	---	---
	7-50	Silty clay loam, silty clay, clay.	CL, CH	A-7, A-4, A-6	0-5	90-100	85-100	70-95	65-90	25-55	9-30
	50-58	Silty clay loam, shaly silty clay, very shaly clay loam.	CH, CL, GC, SC	A-7, A-6, A-4, A-2	0-35	35-100	25-100	25-95	20-90	25-55	9-30
	58-62	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cavode----------	0-10	Silt loam--------	ML, CL	A-4	0-5	90-100	80-100	80-95	75-95	---	---
	10-45	Silty clay loam, silty clay, clay.	ML, CL, CL-ML	A-4, A-7, A-6	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	45-60	Shaly silty clay loam, silty clay, clay.	ML, CL, GC, GM	A-2, A-4, A-6	0-45	50-100	35-100	30-80	25-75	25-45	2-15
WaA, WaB, WaC----	0-9	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	90-100	80-95	70-90	---	---
Wharton	9-46	Clay loam, shaly silty clay loam, shaly silt loam.	ML, CL	A-7, A-6	0-25	75-100	70-100	65-95	60-90	35-45	10-25
	46-69	Silt loam, shaly clay, very shaly silt loam.	ML, GM, SM	A-4, A-6, A-7, A-2	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	69-73	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WhA, WhB--------- Wheeling	0-12	Silt loam---------	ML, CL, SM, SC	A-4	0	90-100	90-100	85-100	45-90	15-35	NP-10
	12-40	Silty clay loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-100	65-100	45-80	20-40	2-20
	40-60	Stratified very fine sand to very gravelly sand.	GM, SM, GP, GW	A-1, A-2, A-3, A-4	10-20	35-90	20-75	10-65	4-45	<20	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
AnA, AnB, AnC----	0-10	10-27	1.20-1.40	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28	3-2	1-4
Andover	10-21	18-35	1.20-1.40	0.6-2.0	0.08-0.12	4.5-5.5	Low----------	0.17		
	21-42	18-35	1.30-1.60	0.06-0.2	0.06-0.10	4.5-5.5	Low----------	0.17		
	42-62	18-40	1.40-1.70	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.17		
AoB, AoC----------	0-10	10-27	1.20-1.40	0.6-2.0	0.08-0.20	4.5-5.5	Low----------	0.17	3-2	1-4
Andover	10-21	18-35	1.20-1.40	0.6-2.0	0.08-0.12	4.5-5.5	Low----------	0.17		
	21-42	18-35	1.30-1.60	0.06-0.2	0.06-0.10	4.5-5.5	Low----------	0.17		
	42-62	18-40	1.40-1.70	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.17		
Ar*:										
Arents.										
Urban land.										
At----------	0-11	18-30	1.20-1.40	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.32	4	2-4
Atkins	11-47	18-35	1.20-1.50	0.06-2.0	0.14-0.18	4.5-5.5	Low----------	0.32		
	47-65	10-35	1.20-1.50	0.2-6.0	0.08-0.18	4.5-5.5	Low----------	0.28		
BeA, BeB, BeC----	0-8	10-25	1.20-1.40	0.2-2.0	0.08-0.16	4.5-6.0	Low----------	0.24	3	1-3
Braceville	8-17	10-25	1.20-1.50	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.20		
	17-33	10-25	1.30-1.60	0.06-0.6	0.06-0.10	5.1-6.5	Low----------	0.20		
	33-72	5-25	1.20-1.40	2.0-20	0.03-0.06	5.1-6.5	Low----------	0.20		
BrA, BrB, BrC----	0-9	15-30	1.20-1.40	0.6-2.0	0.18-0.24	4.5-6.0	Low----------	0.32	3	1-4
Brinkerton	9-20	15-35	1.20-1.50	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.37		
	20-48	15-35	1.40-1.70	0.06-0.2	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	48-60	15-25	1.20-1.60	0.06-0.6	0.14-0.18	5.1-6.5	Low----------	0.20		
BuB, BuC----------	0-6	10-27	1.20-1.40	0.6-2.0	0.14-0.20	3.6-5.5	Low----------	0.32	3-2	1-3
Buchanan	6-29	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	29-64	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.17		
BxB, BxD----------	0-6	10-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.24	3-2	---
Buchanan	6-29	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	29-64	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.17		
Cd----------	0-11	20-40	1.35-1.55	0.2-2.0	0.17-0.21	4.5-6.5	Moderate-----	0.49	5	3-11
Canadice	11-53	35-60	1.40-1.75	<0.06	0.12-0.17	5.1-7.8	Moderate-----	0.28		
	53-80	35-60	1.40-1.50	<0.06	0.13-0.17	6.6-8.4	Moderate-----	0.28		
CeA, CeB----------	0-8	20-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.43	3	2-4
Caneadea	8-60	35-60	1.35-1.70	0.06-0.2	0.10-0.13	4.5-7.8	High---------	0.32		
CeC, CeD----------	0-8	20-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Moderate-----	0.43	3	2-4
Caneadea	8-60	35-60	1.35-1.70	0.06-0.2	0.10-0.13	4.5-7.8	High---------	0.32		
ClA, ClB, ClC, ClD----------	0-10	15-35	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	2-4
Cavode	10-45	35-45	1.20-1.50	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.24		
	45-60	35-45	1.20-1.50	0.06-0.2	0.08-0.12	4.5-5.5	Moderate-----	0.24		
CmB----------	0-8	15-27	1.20-1.40	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24	3	1-4
Clymer	8-38	18-30	1.20-1.50	0.6-2.0	0.08-0.14	3.6-5.5	Low----------	0.15		
	38-44	15-27	1.20-1.40	0.6-2.0	0.04-0.08	3.6-5.5	Low----------	0.15		
	44-48	---	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
CoA, CoB, CoC, CoD----------	0-9	10-27	1.20-1.40	0.6-2.0	0.12-0.16	4.5-5.5	Low----------	0.32	3	1-4
Cookport	9-24	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	24-39	18-35	1.40-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.24		
	39-60	10-27	1.20-1.50	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.24		
Dd*, Dm*. Dumps										
ErB, ErC----------	0-8	15-20	1.20-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.43	3	2-4
Ernest	8-23	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Moderate-----	0.32		
	23-55	18-30	1.40-1.70	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.32		
	55-60	20-35	1.30-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.32		
Fc. Fluvaquents										
FeA, FeB----------	0-10	7-20	1.20-1.40	0.6-2.0	0.12-0.20	5.6-7.3	Low----------	0.28	3	3-5
Fredon	10-30	7-20	1.20-1.40	0.2-2.0	0.12-0.20	5.6-7.3	Low----------	0.24		
	30-60	2-10	1.30-1.50	6.0-20	0.02-0.06	5.6-8.4	Low----------	0.10		
FrA, FrB----------	0-12	15-26	1.20-1.40	0.6-2.0	0.18-0.20	3.6-7.3	Low----------	0.37	3	2-4
Frenchtown	12-17	22-30	1.25-1.60	0.6-2.0	0.16-0.18	3.6-6.0	Low----------	0.37		
	17-65	16-30	1.50-1.75	<0.2	0.08-0.10	4.5-6.5	Low----------	0.37		
GlB, GlC----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3	.5-4
Gilpin	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
GmD----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	.5-4
Gilpin	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
GnC*:										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
Upshur----------	0-6	27-35	1.20-1.50	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.37	3	.5-3
	6-34	40-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-8.4	High----------	0.32		
	34-77	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-8.4	Moderate-----	0.32		
	77-81	---	---	---	---	---	----------	---		
GmD*:										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
Upshur----------	0-6	27-35	1.20-1.50	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.37	3	.5-3
	6-34	40-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-8.4	High----------	0.32		
	34-77	27-45	1.30-1.60	0.06-0.2	0.08-0.12	5.1-8.4	Moderate-----	0.32		
	77-81	---	---	---	---	---	----------	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
GoB*, GoC*, GoD*, GoF*:										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
Weikert--------	0-6	15-27	1.20-1.40	2.0-6.0	0.08-0.14	4.5-6.0	Low----------	0.28	2	1-3
	6-16	15-27	1.20-1.40	2.0-6.0	0.04-0.08	4.5-6.0	Low----------	0.28		
	16-20	---	---	---	---	---	----------	---		
GpC*:										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
Wharton---------	0-9	15-25	1.10-1.30	0.6-2.0	0.16-0.20	4.0-5.5	Low----------	0.37	3	1-4
	9-46	15-35	1.20-1.50	0.06-0.6	0.12-0.16	4.0-5.5	Moderate-----	0.24		
	46-69	20-45	1.20-1.60	0.06-0.6	0.08-0.12	4.0-5.5	Moderate-----	0.17		
	69-73	---	---	---	---	---	----------	---		
GpD*:										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		
Wharton---------	0-9	15-25	1.10-1.30	0.6-2.0	0.16-0.20	4.0-5.5	Low----------	0.37	3	1-4
	9-46	15-35	1.20-1.50	0.06-0.6	0.12-0.16	4.0-5.5	Moderate-----	0.24		
	46-69	20-45	1.20-1.60	0.06-0.6	0.08-0.12	4.0-5.5	Moderate-----	0.17		
	69-73	---	---	---	---	---	----------	---		
GrA, GrB, GrC----	0-8	15-25	1.30-1.50	0.6-2.0	0.19-0.24	3.6-6.5	Low----------	0.37	4	2-4
Gresham	8-21	20-33	1.40-1.70	0.2-2.0	0.16-0.21	3.6-5.5	Moderate-----	0.37		
	21-67	20-32	1.60-1.90	0.06-0.2	0.08-0.12	3.6-6.0	Low----------	0.37		
	67-75	20-32	1.55-1.85	0.2-2.0	0.08-0.12	5.6-7.8	Low----------	0.37		
HaB, HaC, HaD, HaE----------	0-7	7-18	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.17	3	2-4
Hazleton	7-34	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.15		
	34-84	5-15	1.20-1.40	2.0-20	0.06-0.12	3.6-5.5	Low----------	0.15		
	84-88	---	---	---	---	---	----------	---		
HbB----------	0-7	7-18	1.20-1.40	2.0-6.0	0.10-0.16	3.6-5.5	Low----------	0.15	3	2-4
Hazleton	7-34	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.15		
	34-84	5-15	1.20-1.40	2.0-20	0.06-0.12	3.6-5.5	Low----------	0.15		
	84-88	---	---	---	---	---	----------	---		
HgD*, HgF*:										
Hazleton--------	0-7	7-18	1.20-1.40	2.0-6.0	0.10-0.16	3.6-5.5	Low----------	0.15	3	2-4
	7-34	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.15		
	34-84	5-15	1.20-1.40	2.0-20	0.06-0.12	3.6-5.5	Low----------	0.15		
	84-88	---	---	---	---	---	----------	---		
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.08-0.14	3.6-5.5	Low----------	0.24	3	---
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
MoB, MoC----------	0-9	10-27	1.20-1.40	0.6-2.0	0.18-0.24	4.5-5.5	Low----------	0.43	3	2-4
Monongahela	9-20	18-35	1.30-1.50	0.6-2.0	0.14-0.18	4.5-5.5	Low----------	0.43		
	20-40	18-35	1.30-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.43		
	40-60	10-35	1.20-1.40	0.2-0.6	0.08-0.12	4.5-5.5	Low----------	0.37		
Ph----------	0-10	10-18	1.20-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37	5	2-4
Philo	10-46	10-18	1.20-1.40	0.6-2.0	0.10-0.20	4.5-6.0	Low----------	0.32		
	46-60	5-18	1.20-1.40	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.24		
Pn*.										
Pits										
Po----------	0-7	5-15	1.20-1.40	0.6-2.0	0.14-0.23	3.6-5.5	Low----------	0.37	5	1-4
Pope	7-45	5-18	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
	45-80	5-20	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
RdB, RdC----------	0-10	3-10	1.10-1.40	2.0-6.0	0.14-0.20	3.6-6.0	Low----------	0.28	3	2-4
Riverhead	10-20	1-8	1.25-1.55	2.0-6.0	0.09-0.13	3.6-6.0	Low----------	0.28		
	20-27	1-8	1.25-1.55	2.0-6.0	0.04-0.13	4.5-6.0	Low----------	0.17		
	27-60	1-8	1.45-1.65	>20	0.02-0.04	4.5-7.3	Low----------	0.17		
TaA, TaB----------	0-11	10-25	1.20-1.55	0.6-2.0	0.16-0.22	3.6-5.5	Low----------	0.43	3	1-3
Tilsit	11-25	18-35	1.30-1.55	0.6-2.0	0.16-0.22	3.6-5.5	Low----------	0.43		
	25-55	18-35	1.40-1.65	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.43		
	55-60	10-50	1.40-1.60	0.06-0.6	0.08-0.12	3.6-5.5	Low----------	0.43		
TeB, TeC----------	0-9	13-25	1.30-1.50	0.6-2.0	0.18-0.23	3.6-6.5	Low----------	0.37	4	1-3
Titusville	9-23	20-35	1.40-1.70	0.2-0.6	0.14-0.18	3.6-6.0	Moderate-----	0.37		
	23-60	20-30	1.60-1.88	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.37		
TrD*:										
Titusville------	0-9	13-25	1.30-1.50	0.6-2.0	0.18-0.23	3.6-6.5	Low----------	0.37	4	1-3
	9-23	20-35	1.40-1.70	0.2-0.6	0.14-0.18	3.6-6.0	Moderate-----	0.37		
	23-60	20-30	1.60-1.88	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.37		
Riverhead-------	0-10	3-10	1.10-1.40	2.0-6.0	0.14-0.20	3.6-6.0	Low----------	0.28	3	2-4
	10-20	1-8	1.25-1.55	2.0-6.0	0.09-0.13	3.6-6.0	Low----------	0.28		
	20-27	1-8	1.25-1.55	2.0-6.0	0.04-0.13	4.5-6.0	Low----------	0.17		
	27-60	1-8	1.45-1.65	>20	0.02-0.04	4.5-7.3	Low----------	0.17		
UaB, UaD, UaF, UcD, UcF.										
Udorthents										
UeB*, UeC*:										
Urban land.										
Ernest----------	0-8	15-20	1.20-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.43	3	2-4
	8-23	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Moderate-----	0.32		
	23-55	18-30	1.40-1.70	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.32		
	55-60	20-35	1.30-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.32		
UgD*:										
Urban land.										
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	.5-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	30-36	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	36-40	---	---	---	---	---	----------	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
VcB*, VcC*, VcD*:										
Vandergrift-----	0-7	15-30	1.30-1.40	0.6-2.0	0.16-0.20	4.5-6.0	Moderate-----	0.28	3	2-4
	7-50	30-50	1.50-1.70	0.06-0.2	0.10-0.16	4.5-6.5	High---------	0.28		
	50-58	30-45	1.40-1.60	0.06-0.6	0.04-0.14	5.1-7.8	High---------	0.28		
	58-62	---	---	---	---	---	----------	----		
Cavode----------	0-10	15-35	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	2-4
	10-45	35-45	1.20-1.50	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.24		
	45-60	35-45	1.20-1.50	0.06-0.2	0.08-0.12	4.5-5.5	Moderate-----	0.24		
WaA, WaB, WaC----	0-9	15-25	1.10-1.30	0.6-2.0	0.16-0.20	4.0-5.5	Low----------	0.37	3	1-4
Wharton	9-46	15-35	1.20-1.50	0.06-0.6	0.12-0.16	4.0-5.5	Moderate-----	0.24		
	46-69	20-45	1.20-1.60	0.06-0.6	0.08-0.12	4.0-5.5	Moderate-----	0.17		
	69-73	---	---	---	---	---	----------	----		
WhA, WhB---------	0-12	12-20	1.20-1.40	0.6-6.0	0.12-0.18	5.1-6.5	Low----------	0.37	4	1-3
Wheeling	12-40	18-30	1.30-1.50	0.6-2.0	0.08-0.16	5.1-6.0	Low----------	0.32		
	40-60	8-15	1.30-1.50	6.0-20	0.04-0.08	5.1-6.0	Low----------	0.20		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the
< means less than; > means more than. Absence of an entry indicates that the feature is not a concern or t
estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
AnA, AnB, AnC, AoB, AoC---------- Andover	D	None--------	---	---	0-0.5	Perched	Oct-Jun	>60	---	High-----
Ar*: Arents. Urban land.										
At---------- Atkins	D	Frequent----	Very brief	Sep-Jul	0-1.0	Apparent	Nov-Jun	>60	---	High-----
BeA, BeB, BeC----- Braceville	C	None--------	---	---	0.5-3.0	Perched	Nov-Mar	>60	---	Moderate
BrA, BrB, BrC----- Brinkerton	D	None--------	---	---	0-0.5	Perched	Oct-May	>60	---	High-----
BuB, BuC, BxB, BxD---------- Buchanan	C	None--------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	Moderate
Cd---------- Canadice	D	None--------	---	---	+1-1.0	Apparent	Dec-Jun	>60	---	Moderate
CeA, CeB---------- Caneadea	D	None--------	---	---	1.0-2.5	Perched	Dec-May	>60	---	High-----
CeC, CeD---------- Caneadea	D	None--------	---	---	0.5-2.5	Perched	Dec-May	>60	---	High-----
ClA, ClB, ClC, ClD---------- Cavode	C	None--------	---	---	0.5-1.5	Perched	Oct-May	40-72	Soft	High-----

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
CmB---------- Clymer	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate
CoA, CoB, CoC, CoD---------- Cookport	C	None--------	---	---	1.5-2.5	Perched	Dec-Apr	40-72	Hard	Moderate
Dd*, Dm*. Dumps										
ErB, ErC---------- Ernest	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate
Fc. Fluvaquents										
FeA, FeB---------- Fredon	C	None--------	---	---	0-1.5	Apparent	Oct-Jun	>60	---	High-----
FrA, FrB---------- Frenchtown	D	None--------	---	---	+1-1.0	Perched	Oct-May	>60	---	High-----
GlB, GlC, GmD----- Gilpin	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate
GnC*, GnD*: Gilpin----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate
Upshur----------	D	None--------	---	---	>6.0	---	---	>40	Soft	Moderate
GoB*, GoC*, GoD*, GoF*: Gilpin----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate
Weikert---------	C/D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate
GpC*, GpD*: Gilpin----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	U
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		
					Ft			In			
GpC*, GpD*: Wharton	C	None	---	---	1.5-3.0	Perched	Nov-Mar	>40	Soft	High	H
GrA, GrB, GrC---- Gresham	C	None	---	---	0.5-2.0	Perched	Nov-Jun	>60	---	High	H
HaB, HaC, HaD, HaE, HbB---- Hazleton	B	None	---	---	>6.0	---	---	>40	Hard	Moderate	L
HgD*, HgF*: Hazleton	B	None	---	---	>6.0	---	---	>40	Hard	Moderate	L
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	L
MoB, MoC---- Monongahela	C	None	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	H
Ph---- Philo	B	Frequent	Very brief	Dec-May	1.5-3.0	Apparent	Dec-Apr	>40	Hard	Moderate	L
Pn*. Pits											
Po---- Pope	B	Occasional	Very brief to brief.	Nov-Apr	>6.0	---	---	>60	---	Moderate	L
RdB, RdC---- Riverhead	B	None	---	---	>6.0	---	---	>60	---	Moderate	L
TaA, TaB---- Tilsit	C	None	---	---	1.5-2.5	Perched	Jan-Apr	>40	Hard	---	H
TeB, TeC---- Titusville	C	None	---	---	1.5-3.0	Perched	Nov-May	>60	---	High	M
TrD*: Titusville	C	None	---	---	1.5-3.0	Perched	Nov-May	>60	---	High	M

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	U
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		
					Ft			In			
TrD*: Riverhead	B	None	---	---	>6.0	---	---	>60	---	Moderate	L
UaB, UaD, UaF, UcD, UcF. Udorthents											
UeB*, UeC*: Urban land.											
Ernest	C	None	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	M
UgD*: Urban land.											
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	L
VcB*, VcC*, VcD*: Vandergrift	C	None	---	---	0.5-3.0	Perched	Nov-Mar	>40	Soft	High	H
Cavode	C	None	---	---	0.5-1.5	Perched	Oct-May	40-72	Soft	High	H
WaA, WaB, WaC Wharton	C	None	---	---	1.5-3.0	Perched	Nov-Mar	>40	Soft	High	H
WhA, WhB Wheeling	B	None	---	---	>6.0	---	---	>60	---	Moderate	L

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Andover	Fine-loamy, mixed, mesic Typic Fragiaquults
Arents	Arents
Atkins	Fine-loamy, mixed, acid, mesic Typic Fluvaquents
Braceville	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Brinkerton	Fine-silty, mixed, mesic Typic Fragiaqualfs
Buchanan	Fine-loamy, mixed, mesic Aquic Fragiudults
Canadice	Fine, illitic, mesic Typic Ochraqualfs
Caneadea	Fine, illitic, mesic Aeric Ochraqualfs
Cavode	Clayey, mixed, mesic Aeric Ochraquults
Clymer	Fine-loamy, mixed, mesic Typic Hapludults
Cookport	Fine-loamy, mixed, mesic Aquic Fragiudults
Ernest	Fine-loamy, mixed, mesic Aquic Fragiudults
Fluvaquents	Fluvaquents
Fredon	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic Aeric Haplaquepts
Frenchtown	Fine-loamy, mixed, mesic Typic Fragiaqualfs
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Gresham	Fine-loamy, mixed, mesic Aeric Fragiaqualfs
Hazleton	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Monongahela	Fine-loamy, mixed, mesic Typic Fragiudults
Philo	Coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Riverhead	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Tilsit	Fine-silty, mixed, mesic Typic Fragiudults
Titusville	Fine-loamy, mixed, mesic Aquic Fragiudalfs
Udorthents	Udorthents
Upshur	Fine, mixed, mesic Typic Hapludalfs
Vandergrift	Fine, mixed, mesic Aquic Hapludalfs
Weikert	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts
Wharton	Fine-loamy, mixed, mesic Aquic Hapludults
Wheeling	Fine-loamy, mixed, mesic Ultic Hapludalfs

☆U.S. GOVERNMENT PRINTING OFFICE : 1989 O - 493-514 : QL 3

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Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

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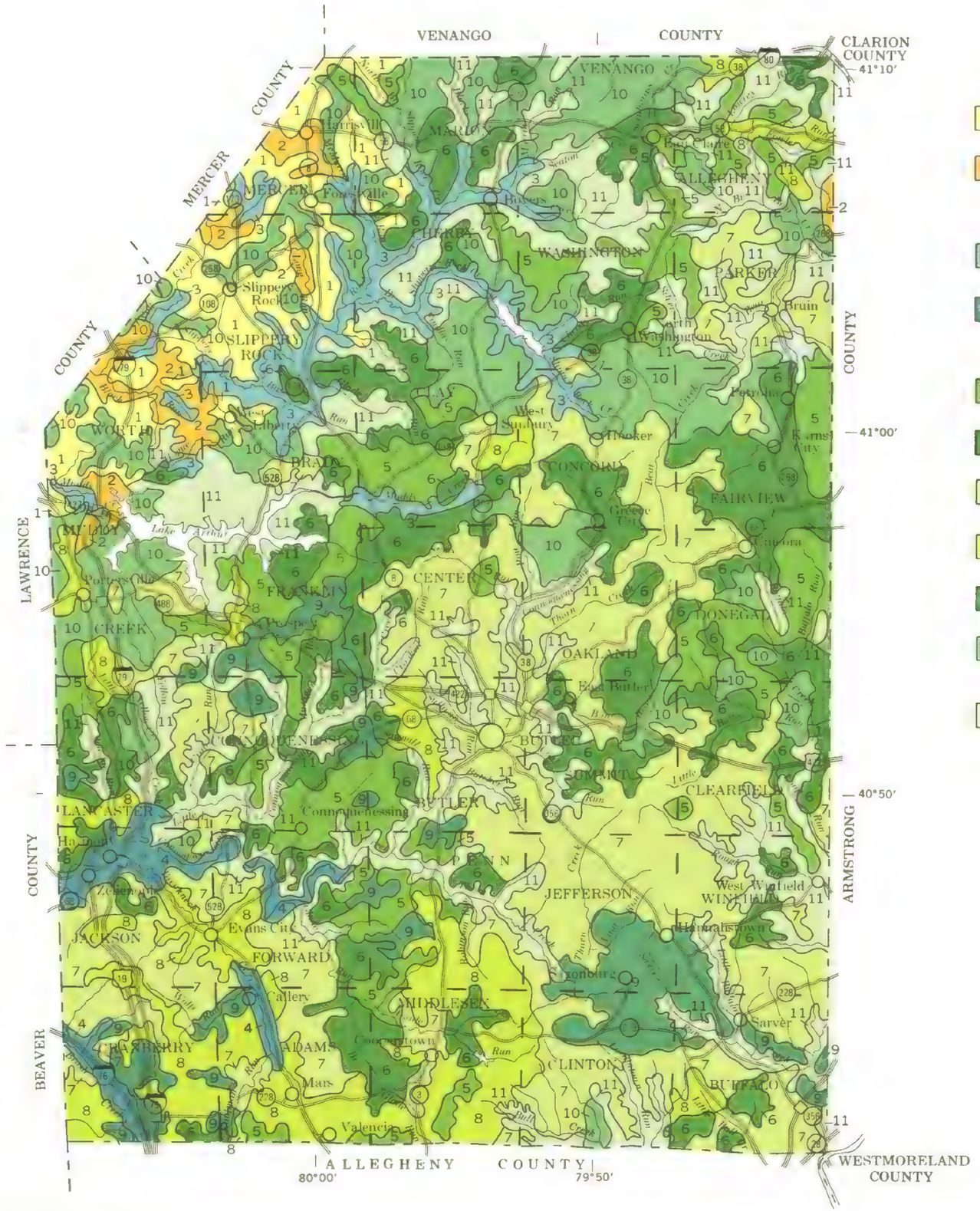


N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

LEGEND

VERY DEEP SOILS FORMED IN GLACIAL MATERIAL

1 — Gresham-Titusville-Frenchtown: Nearly level to steep, very deep, moderately well drained to poorly drained soils formed in glacial till

2 — Riverhead-Braceville-Wheeling: Nearly level to steep, very deep, well drained and moderately well drained soils formed in glacial outwash

VERY DEEP SOILS FORMED IN ALLUVIUM AND LACUSTRINE SEDIMENTS

3 — Atkins-Canadice-Caneadea: Nearly level to moderately steep, very deep, poorly drained and somewhat poorly drained soils formed in alluvium and lacustrine sediments

4 — Monongahela-Atkins-Caneadea: Nearly level to strongly sloping, very deep, moderately well drained to poorly drained soils formed in alluvium and slackwater or lacustrine sediments

MODERATELY DEEP TO VERY DEEP SOILS FORMED DOMINANTLY IN RESIDUAL MATERIAL

5 — Hazleton-Cookport-Buchanan: Nearly level to steep, deep and very deep, well drained and moderately well drained soils formed in material weathered dominantly from sandstone

6 — Hazleton-Gilpin-Wharton: Nearly level to steep, moderately deep and deep, well drained and moderately well drained soils formed in material weathered dominantly from sandstone and siltstone

7 — Gilpin-Wharton: Gently sloping to very steep, moderately deep and deep, well drained and moderately well drained soils formed in material weathered dominantly from siltstone and shale

8 — Cavode-Wharton-Gilpin: Gently sloping to steep, deep and moderately deep, somewhat poorly drained to well drained soils formed in material weathered dominantly from shale

9 — Tilsit-Brinkerton-Gilpin: Nearly level to moderately steep, moderately deep to very deep, well drained to poorly drained soils formed in material weathered dominantly from shale and siltstone

10 — Udorthents-Wharton-Hazleton: Gently sloping to very steep, very deep and deep, excessively drained to moderately well drained soils formed during strip mining and in material weathered from sandstone, siltstone, and shale

11 — Hazleton-Buchanan-Gilpin: Gently sloping to very steep, moderately deep to very deep, well drained and moderately well drained, dominantly very stony soils formed in material weathered from sandstone, siltstone, and shale

COMPILED 1985

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
THE AGRICULTURAL EXPERIMENT STATION
THE COOPERATIVE EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE,
THE PENNSYLVANIA STATE UNIVERSITY
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE

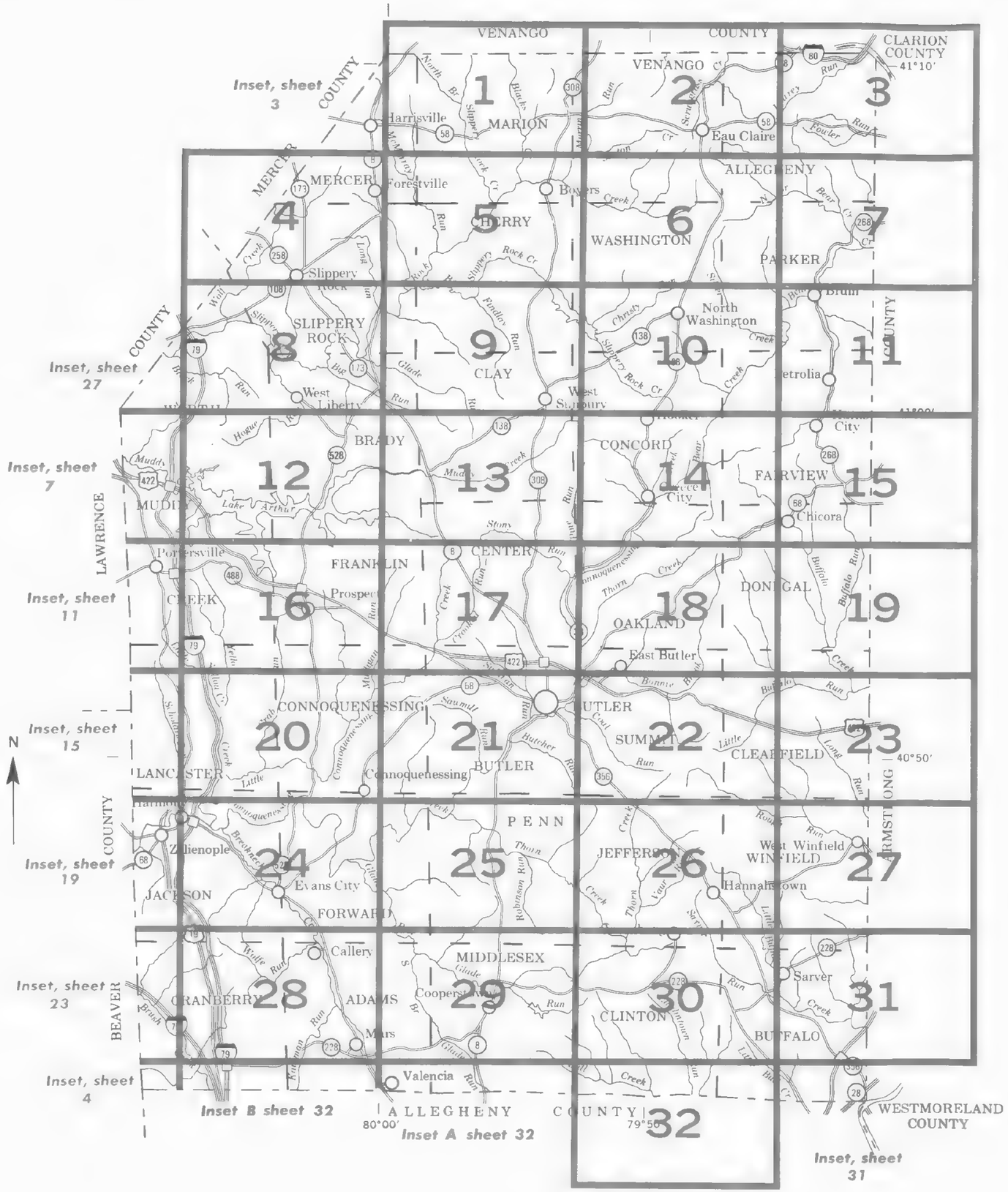
GENERAL SOIL MAP

BUTLER COUNTY, PENNSYLVANIA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km



INDEX TO MAP SHEETS
BUTLER COUNTY, PENNSYLVANIA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

BUTLER COUNTY, PENNSYLVANIA

AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
PENNSYLVANIA STATE UNIVERSITY
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
PENNSYLVANIA DEPARTMENT OF AGRICULTURE

SOIL LEGEND

Publication symbols consist of letters (e.g. AnA, GrB). The first letter, always a capital, is the initial letter of the soil name. The second letter separates map units, except that it does not separate slope phases. The third letter, always a capital; A, B, C, D, E, or F indicates the slope. Symbols without a slope letter are for nearly level soils, some soils named for higher categories with considerable range of slopes, or for miscellaneous areas.

SYMBOL	NAME
AnA	Andover loam, 0 to 3 percent slopes
AnB	Andover loam, 3 to 8 percent slopes
AnC	Andover loam, 8 to 15 percent slopes
AoB	Andover loam, 0 to 8 percent slopes, very stony
AoC	Andover loam, 8 to 15 percent slopes, very stony
Ar	Arents-Urban land complex
At	Atkins silt loam
BeA	Braceville loam, 0 to 3 percent slopes
BeB	Braceville loam, 3 to 8 percent slopes
BeC	Braceville loam, 8 to 15 percent slopes
BrA	Brinkerton silt loam, 0 to 3 percent slopes
BrB	Brinkerton silt loam, 3 to 8 percent slopes
BrC	Brinkerton silt loam, 8 to 15 percent slopes
BuB	Buchanan loam, 3 to 8 percent slopes
BuC	Buchanan loam, 8 to 15 percent slopes
BxB	Buchanan loam, 0 to 8 percent slopes, very stony
BxD	Buchanan loam, 8 to 25 percent slopes, very stony
Cd	Canadice silty clay loam
CeA	Caneadea silt loam, 0 to 3 percent slopes
CeB	Caneadea silt loam, 3 to 8 percent slopes
CeC	Caneadea silt loam, 8 to 15 percent slopes
CeD	Caneadea silt loam, 15 to 25 percent slopes
CIA	Cavode silt loam, 0 to 3 percent slopes
CIB	Cavode silt loam, 3 to 8 percent slopes
CIC	Cavode silt loam, 8 to 15 percent slopes
CID	Cavode silt loam, 15 to 25 percent slopes
CmB	Clymer loam, 3 to 8 percent slopes
CoA	Cookport loam, 0 to 3 percent slopes
CoB	Cookport loam, 3 to 8 percent slopes
CoC	Cookport loam, 8 to 15 percent slopes
CoD	Cookport loam, 15 to 25 percent slopes
Dd	Dumps, industrial waste
Dm	Dumps, mine
ErB	Ernest silt loam, 3 to 8 percent slopes
ErC	Ernest silt loam, 8 to 15 percent slopes
Fc	Fluvaquents, coal overwash
FeA	Fredon loam, 0 to 3 percent slopes
FeB	Fredon loam, 3 to 8 percent slopes
FrA	Frenchtown silt loam, 0 to 3 percent slopes
FrB	Frenchtown silt loam, 3 to 8 percent slopes
GlB	Gilpin silt loam, 3 to 8 percent slopes
GlC	Gilpin silt loam, 8 to 15 percent slopes
GmD	Gilpin channery silt loam, 15 to 25 percent slopes
GnC	Gilpin-Upshur complex, 8 to 15 percent slopes
GnD	Gilpin-Upshur complex, 15 to 30 percent slopes
GoB	Gilpin-Weikert channery silt loams, 3 to 8 percent slopes
GoC	Gilpin-Weikert channery silt loams, 8 to 15 percent slopes
GoD	Gilpin-Weikert channery silt loams, 15 to 25 percent slopes
GoF	Gilpin-Weikert channery silt loams, 25 to 70 percent slopes
GpC	Gilpin-Wharton silt loams, 8 to 15 percent slopes
GpD	Gilpin-Wharton complex, 15 to 25 percent slopes
GrA	Gresham silt loam, 0 to 3 percent slopes
GrB	Gresham silt loam, 3 to 8 percent slopes
GrC	Gresham silt loam, 8 to 15 percent slopes
HaB	Hazleton channery loam, 3 to 8 percent slopes
HaC	Hazleton channery loam, 8 to 15 percent slopes
HaD	Hazleton channery loam, 15 to 25 percent slopes
HaE	Hazleton channery loam, 25 to 35 percent slopes
HbD	Hazleton loam, 0 to 8 percent slopes, very stony
HgD	Hazleton and Gilpin soils, 8 to 25 percent slopes, very stony
HgF	Hazleton and Gilpin soils, 25 to 70 percent slopes, very stony
MoB	Monongahela silt loam, 3 to 8 percent slopes
MoC	Monongahela silt loam, 8 to 15 percent slopes
Ph	Philo loam
Pn	Pits, sand and gravel
Po	Pope loam
RdB	Riverhead sandy loam, 3 to 8 percent slopes
RdC	Riverhead sandy loam, 8 to 15 percent slopes
TaA	Tilsit silt loam, 0 to 3 percent slopes
TaB	Tilsit silt loam, 3 to 8 percent slopes
TeB	Titusville silt loam, 3 to 8 percent slopes
TeC	Titusville silt loam, 8 to 15 percent slopes
TrD	Titusville and Riverhead soils, 15 to 30 percent slopes
UaB	Udorthents, acid material, gently sloping
UaD	Udorthents, acid material, moderately steep
UaF	Udorthents, acid material, very steep
UcD	Udorthents, calcareous material, moderately steep
UcF	Udorthents, calcareous material, very steep
UeB	Urban land-Ernest complex, 0 to 8 percent slopes
UeC	Urban land-Ernest complex, 8 to 15 percent slopes
UgD	Urban land-Gilpin complex, 15 to 25 percent slopes
VcB	Vandergrift-Cavode silt loams, 3 to 8 percent slopes
VcC	Vandergrift-Cavode silt loams, 8 to 15 percent slopes
VcD	Vandergrift-Cavode silt loams, 15 to 25 percent slopes
WaA	Wharton silt loam, 0 to 3 percent slopes
WaB	Wharton silt loam, 3 to 8 percent slopes
WaC	Wharton silt loam, 8 to 15 percent slopes
WhA	Wheeling silt loam, 0 to 3 percent slopes
WhB	Wheeling silt loam, 3 to 8 percent slopes
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label) — Hedley Airstrip
- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE
- STATE COORDINATE TICK
- LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 78
- County, farm or ranch — 1283

- RAILROAD
- POWER TRANSMISSION LINE (normally not shown)
- PIPE LINE (normally not shown)
- FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water — w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water — w
- Intermittent — int — i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS — GoB | HaB
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE SITE (normally not shown) — S
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot — 0

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 1

1

N

1 385 000 FEET

680 000 FEET

79° 52'30"

41° 11' 15"

VENANGO COUNTY

(Joins inset, sheet 3)

(Joins sheet 2)

(Joins sheet 5)

41° 07' 30"

80° 00' 00"

1 410 000 FEET

580 000 FEET

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 1

N

1 420 000 FEET

680 000 FEET

79°45'00"

41°11'15"

VENANGO COUNTY

Eakin Knob

Sandy Point

Sedwick Mills

Cherry Valley

Kellmeyer Corner

De Sale

Fay Claire

Tri Points

Creek

Sedum

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 6)

1 445 000 FEET

650 000 FEET

41° 07'30"
79° 52'30"

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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 2

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 3

N

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 4

4
N

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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 5

5
N

1 3/4 1/2 1/4 0 1 MILE
0 0.5 0 1 KILOMETER
SCALE 1:15 840

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BUTLER COUNTY, PENNSYLVANIA NO. 5

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 6

6

N

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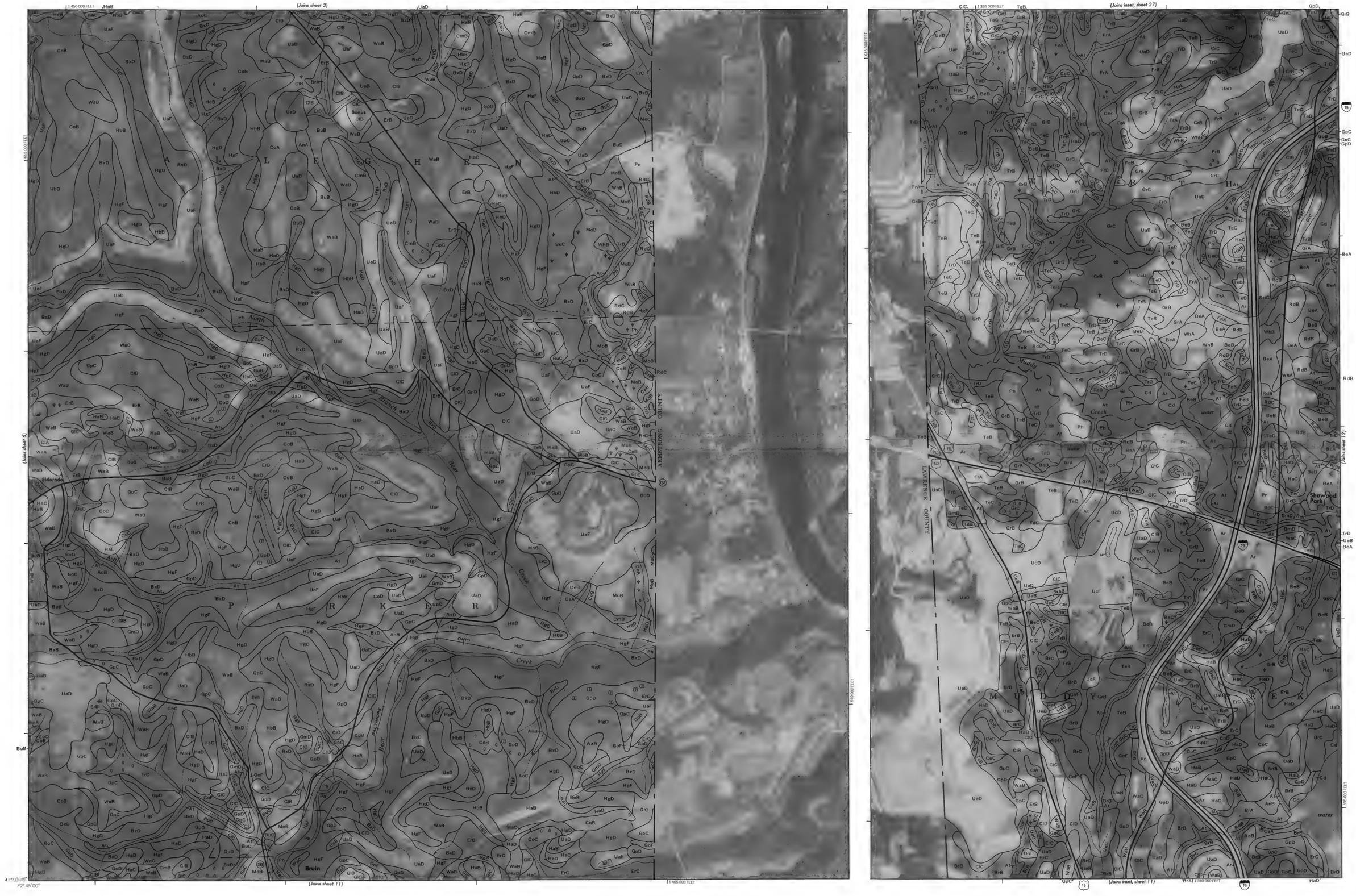
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 6



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1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 7

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 8

8
N

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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 8

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 9

9
N

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1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 9

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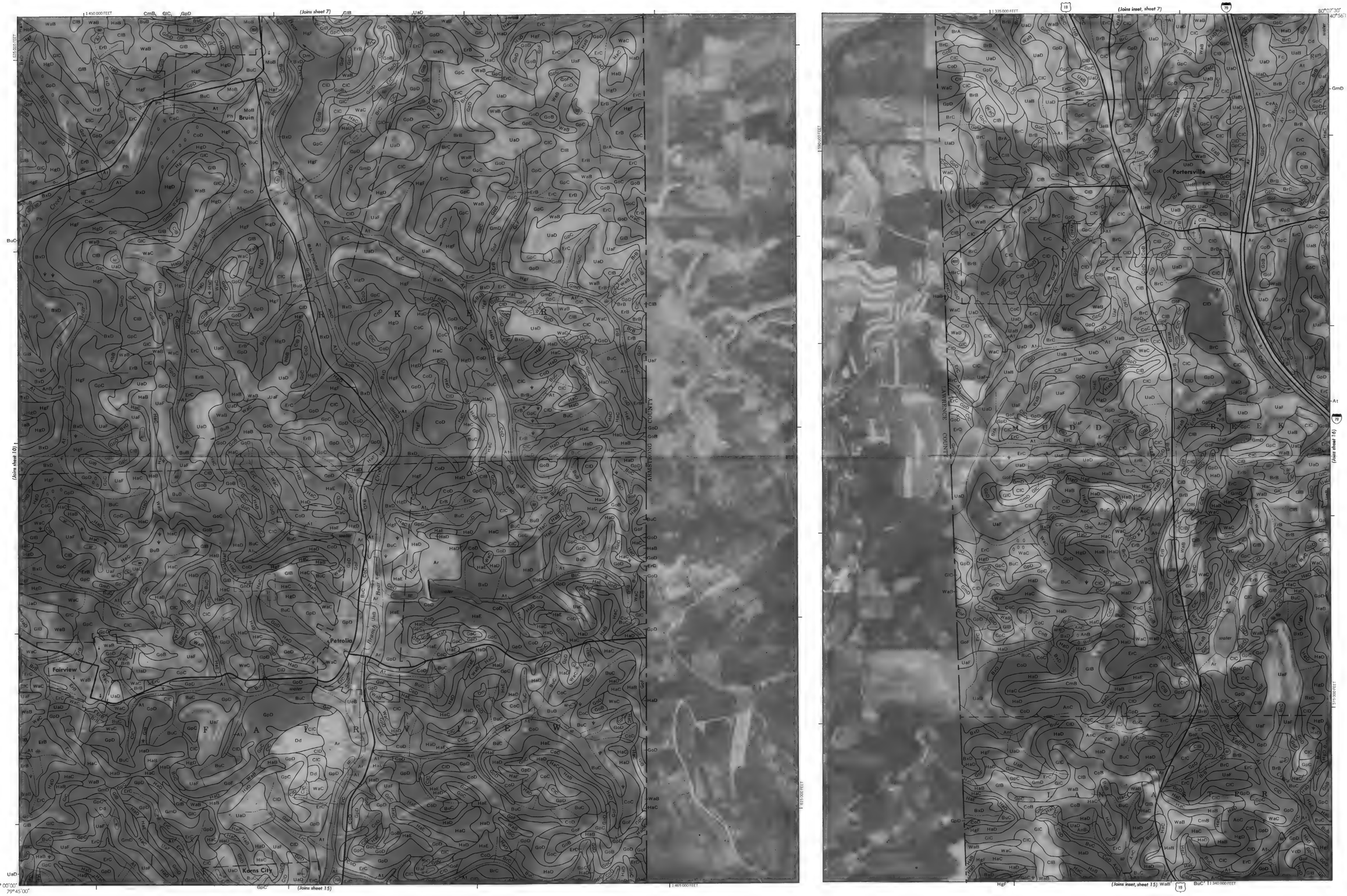
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 10

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 11

N



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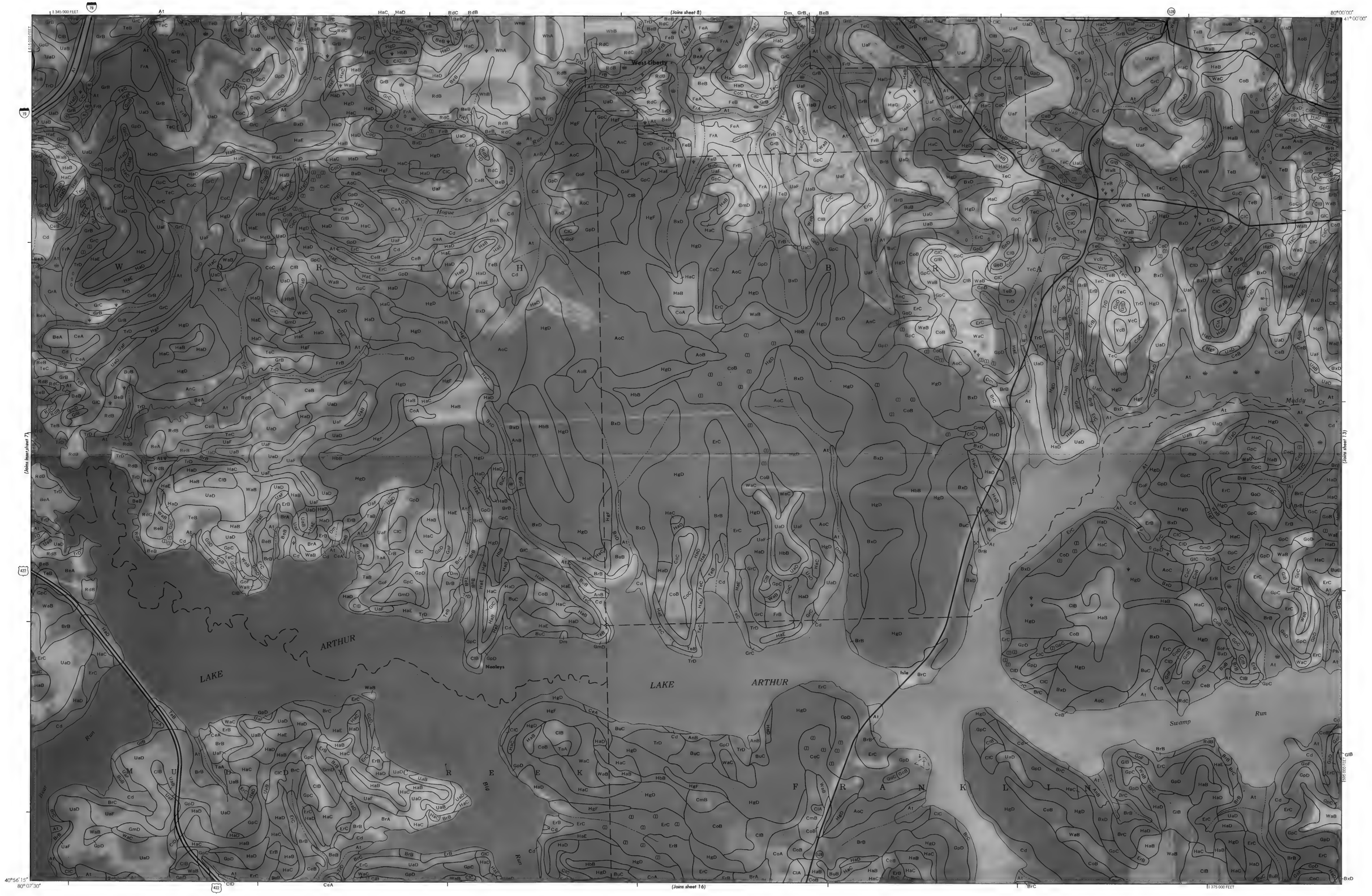
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 11

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 12

12
N



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 12

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 13

13
N

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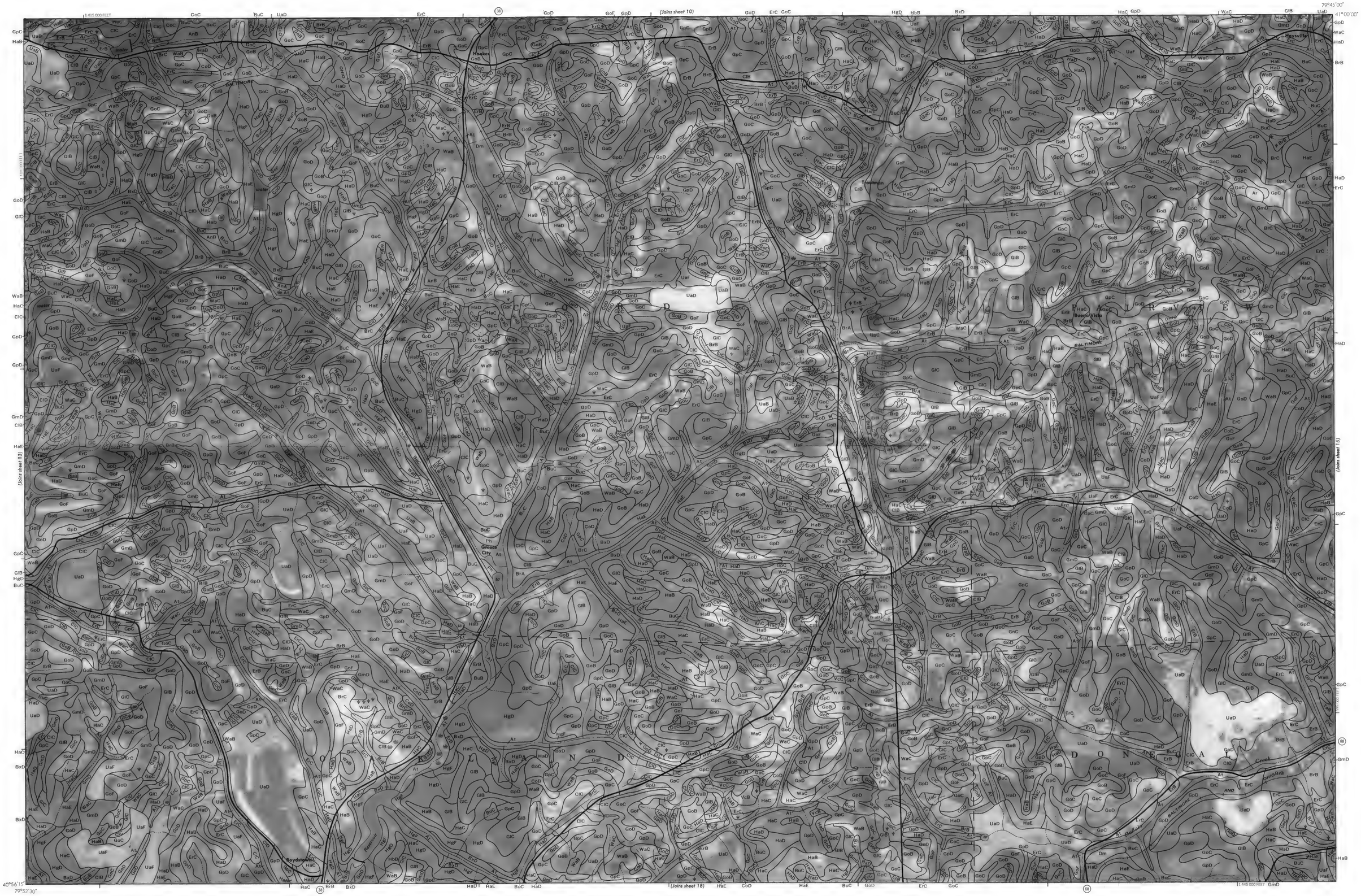
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 13

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 14

N



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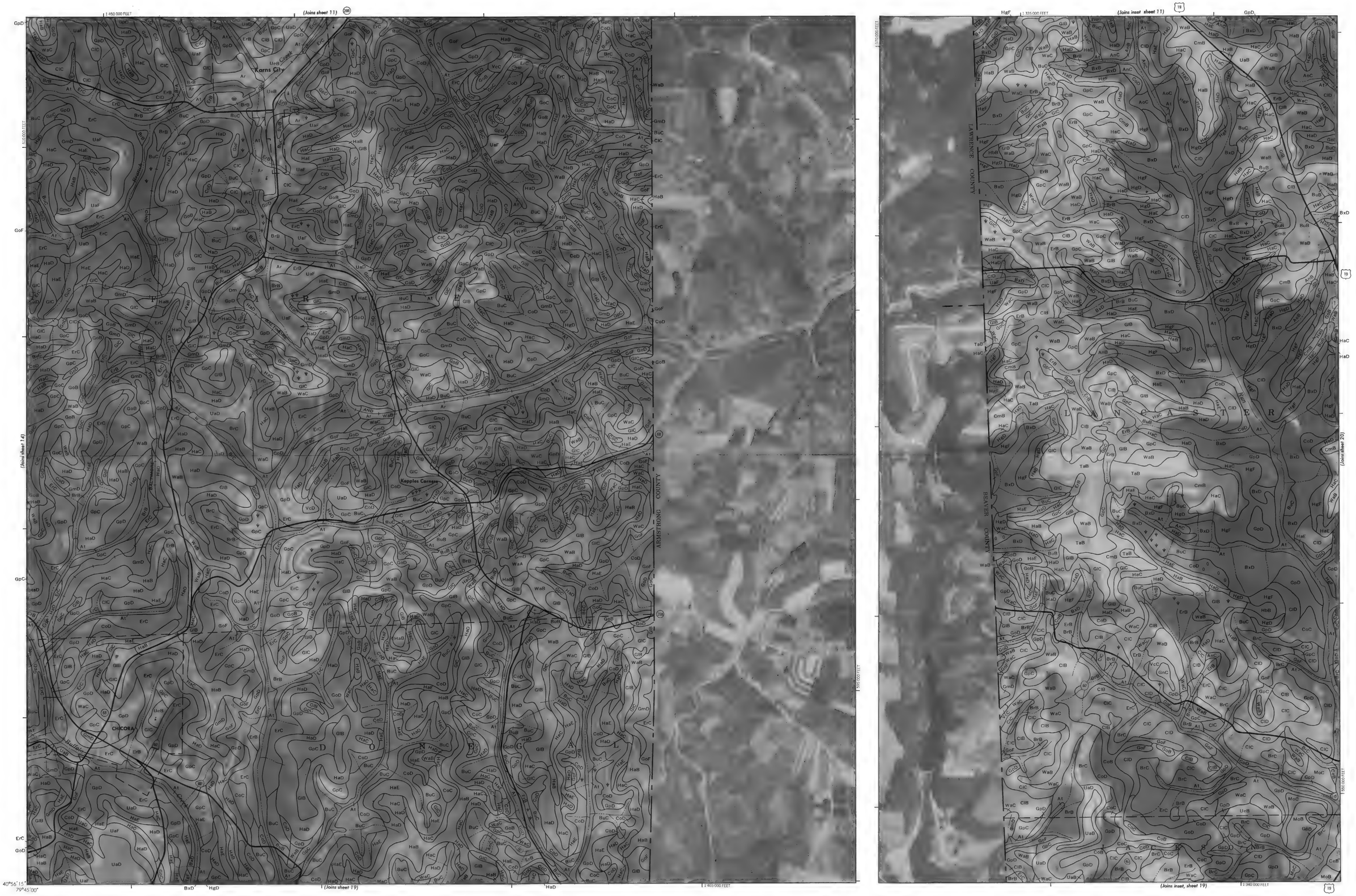
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 14



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

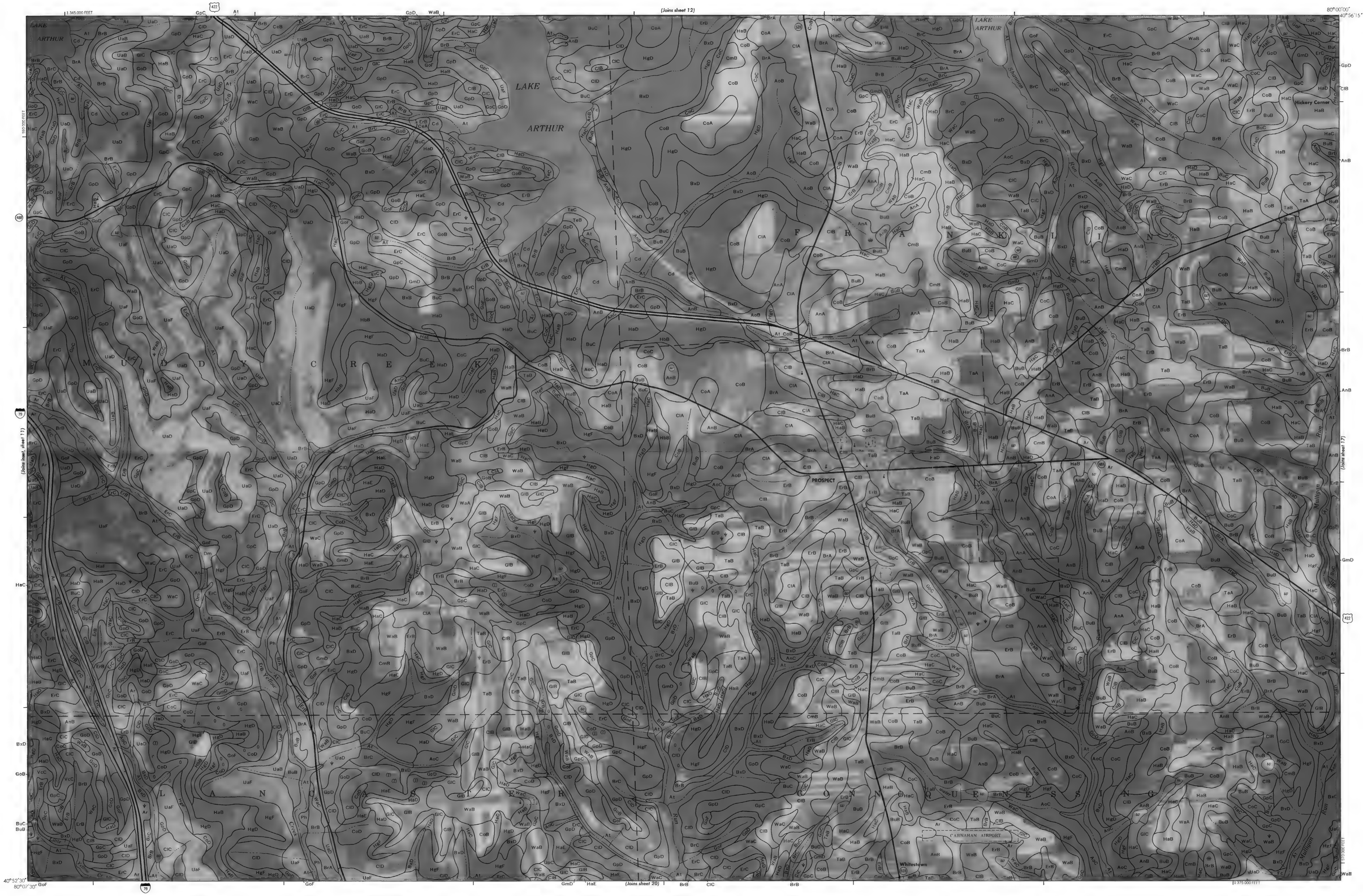
BUTLER COUNTY, PENNSYLVANIA NO. 15

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 16

16

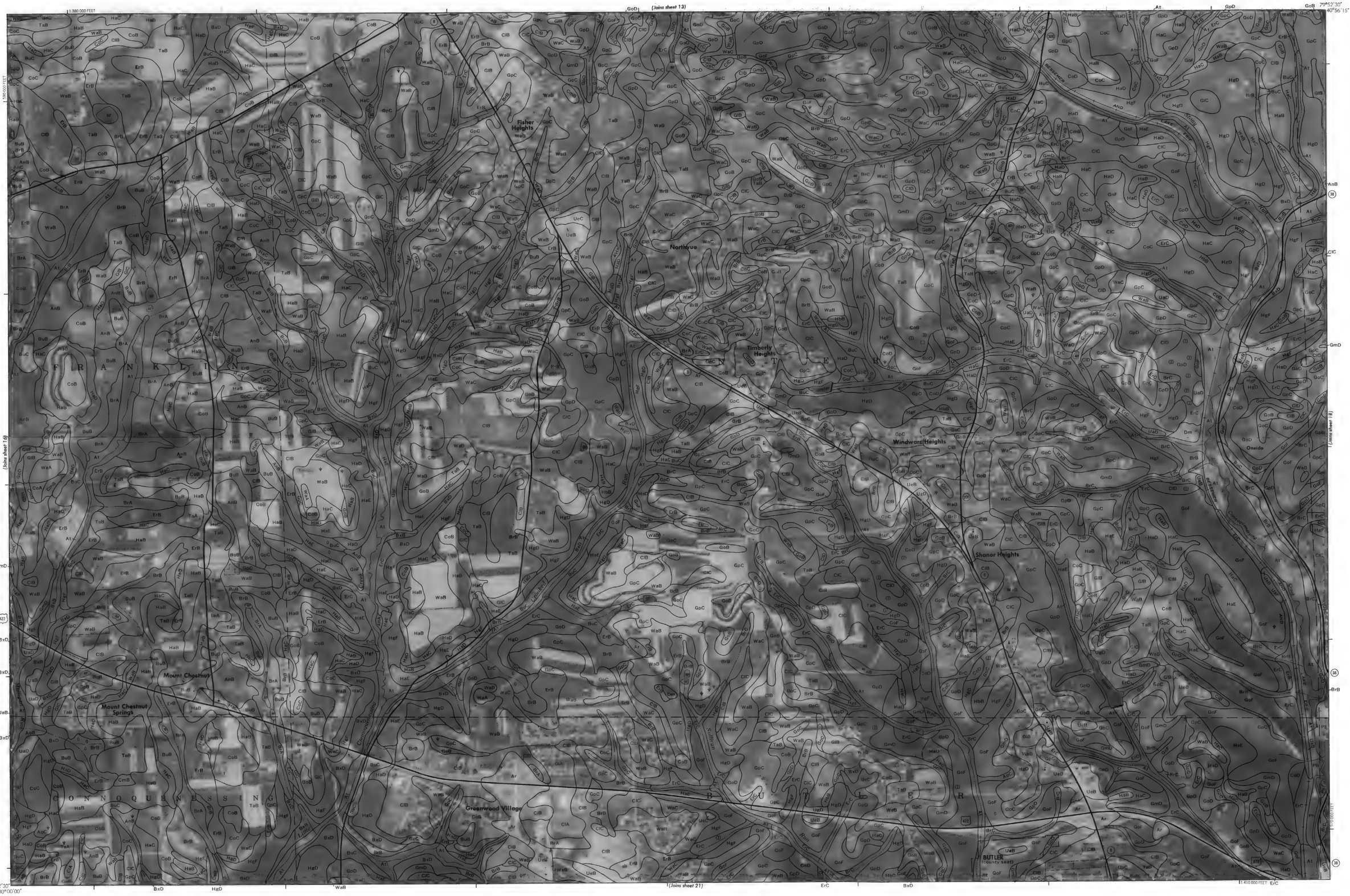
N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 16



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 17

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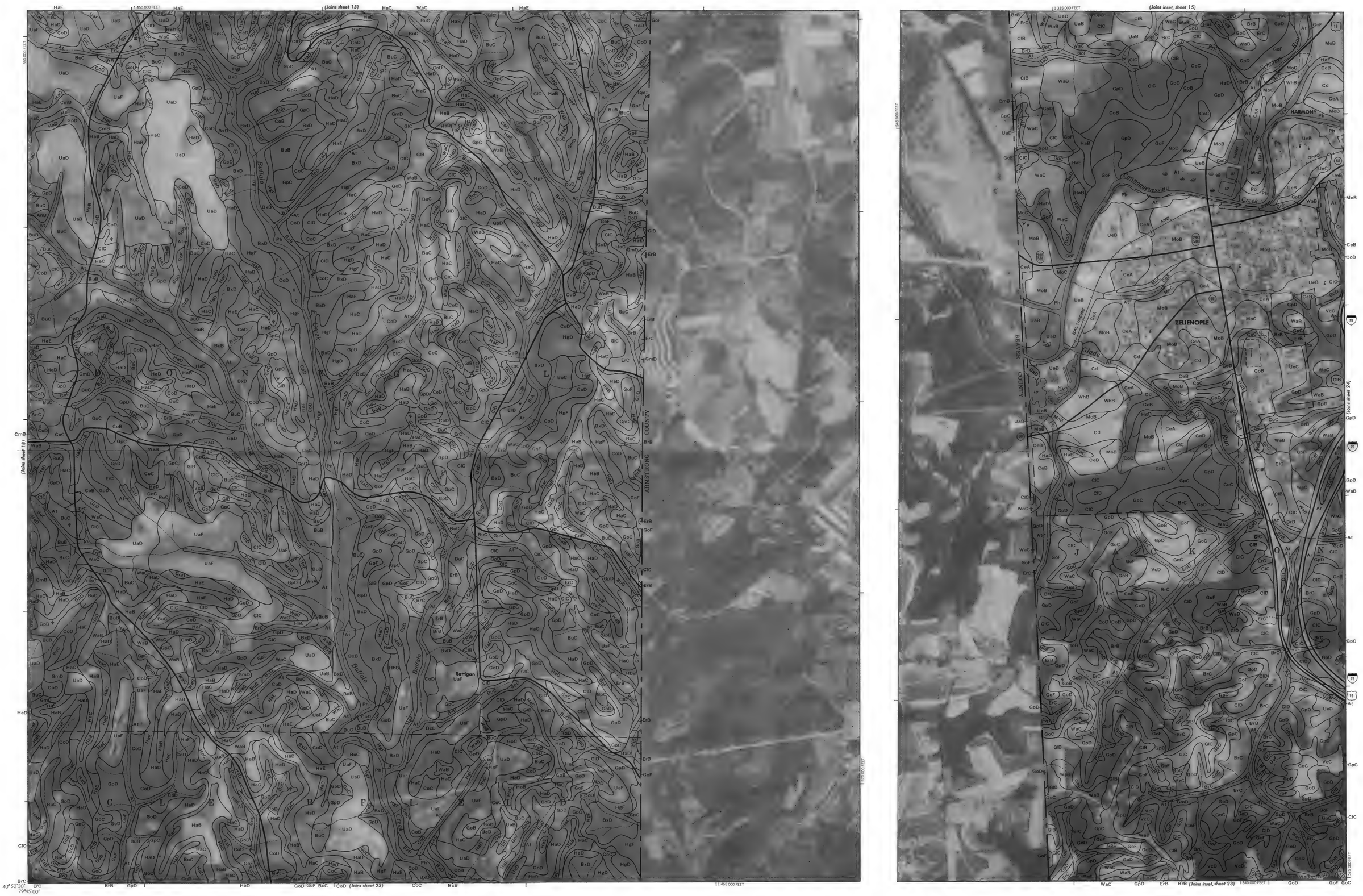
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 18



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 19

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 20

20

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

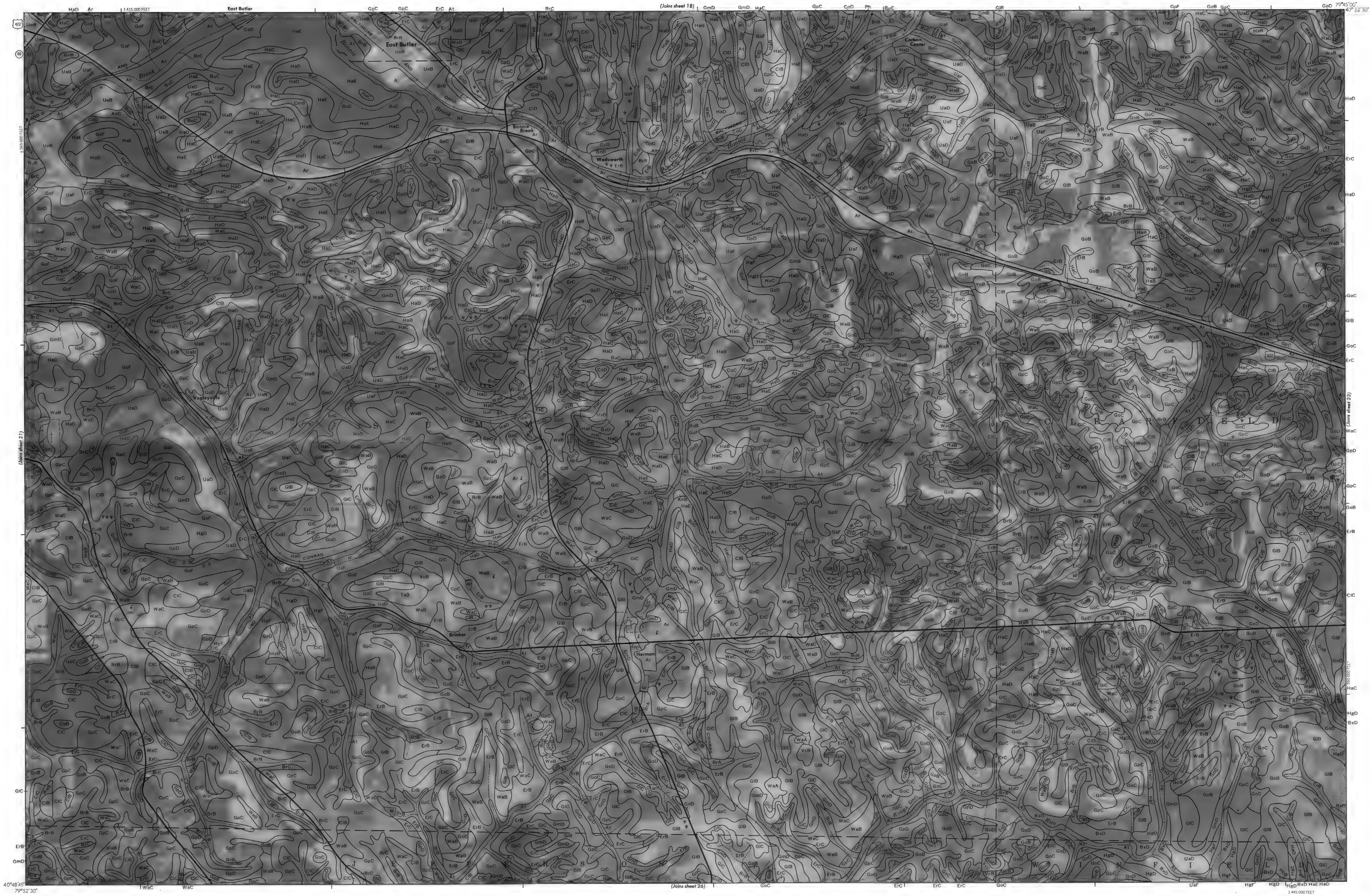
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 20

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

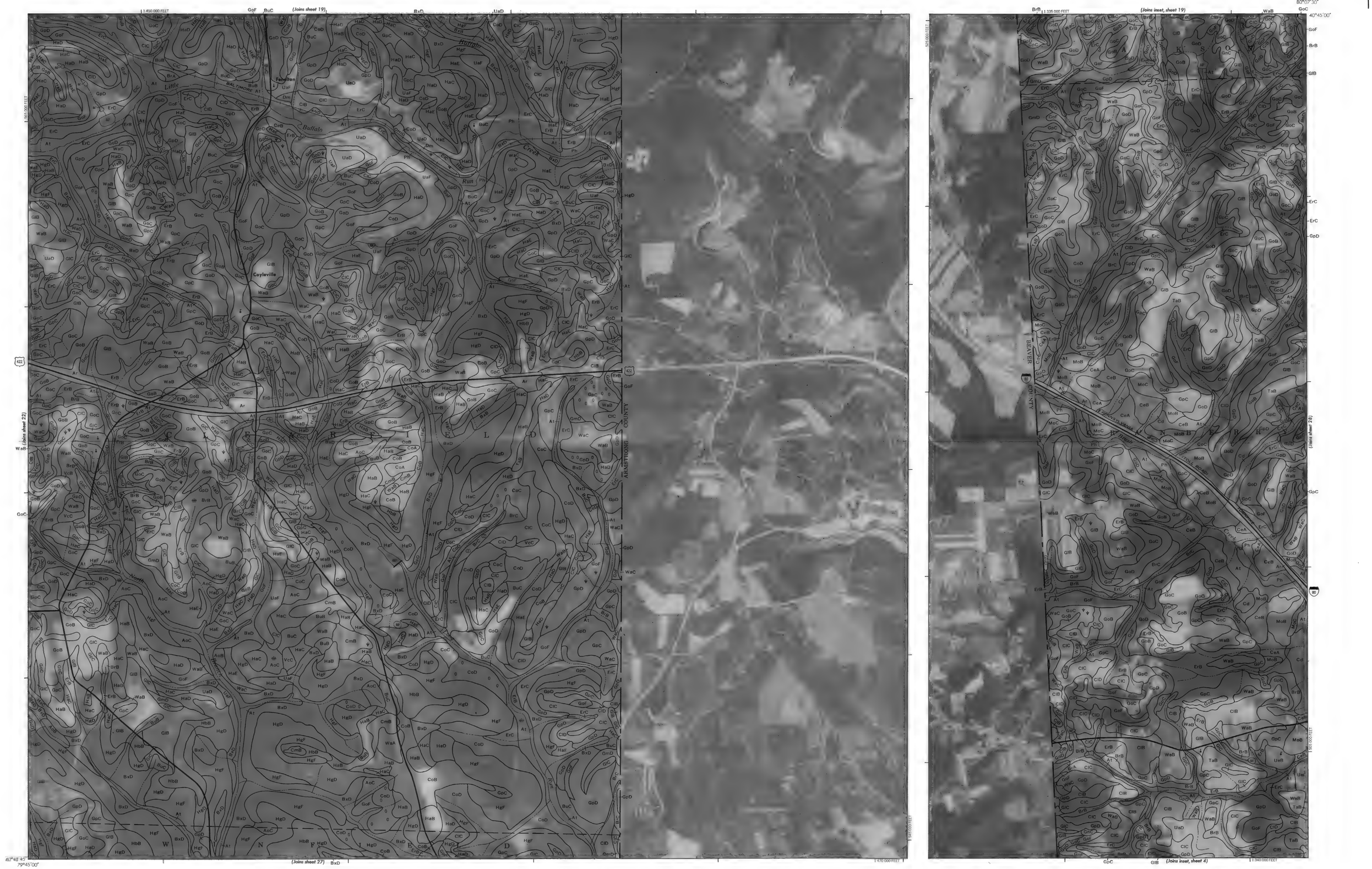
BUTLER COUNTY, PENNSYLVANIA NO. 21



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 22



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 23

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 24

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 25

25
N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BUTLER COUNTY, PENNSYLVANIA NO. 25

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

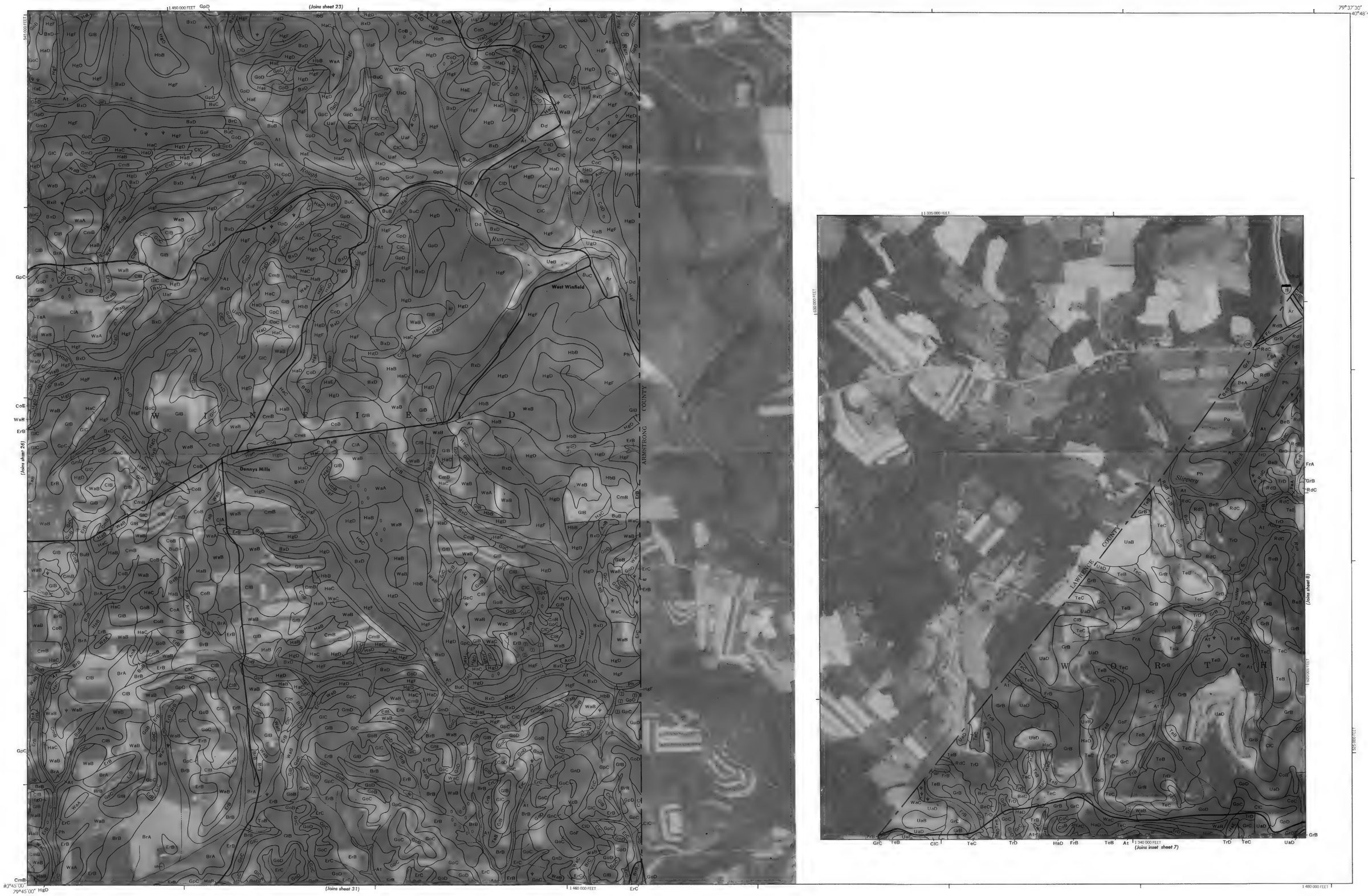
SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 26

26
N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 26



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 27

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

N

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 29

29

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

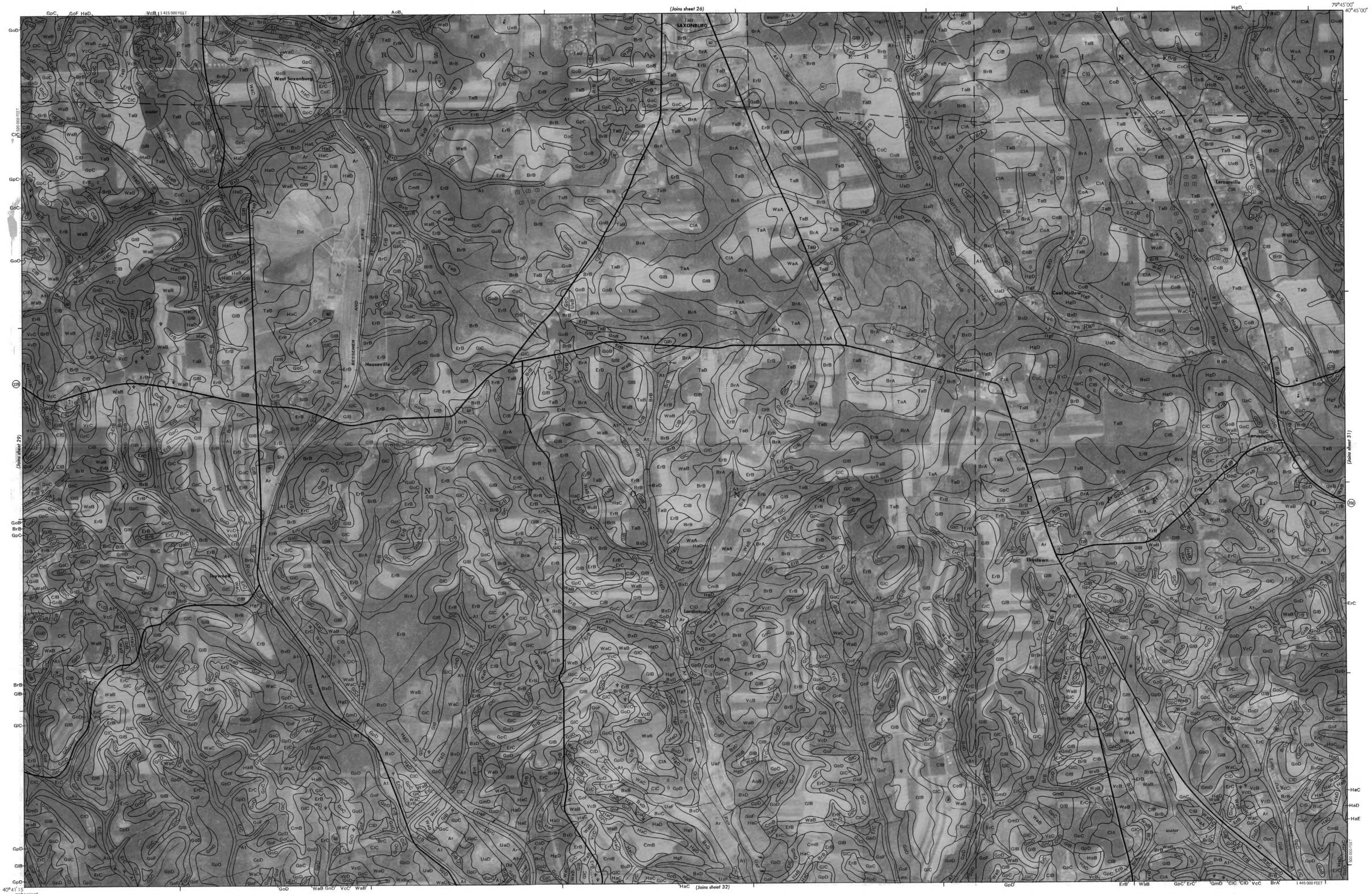
BUTLER COUNTY, PENNSYLVANIA NO. 29

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 30

30

N



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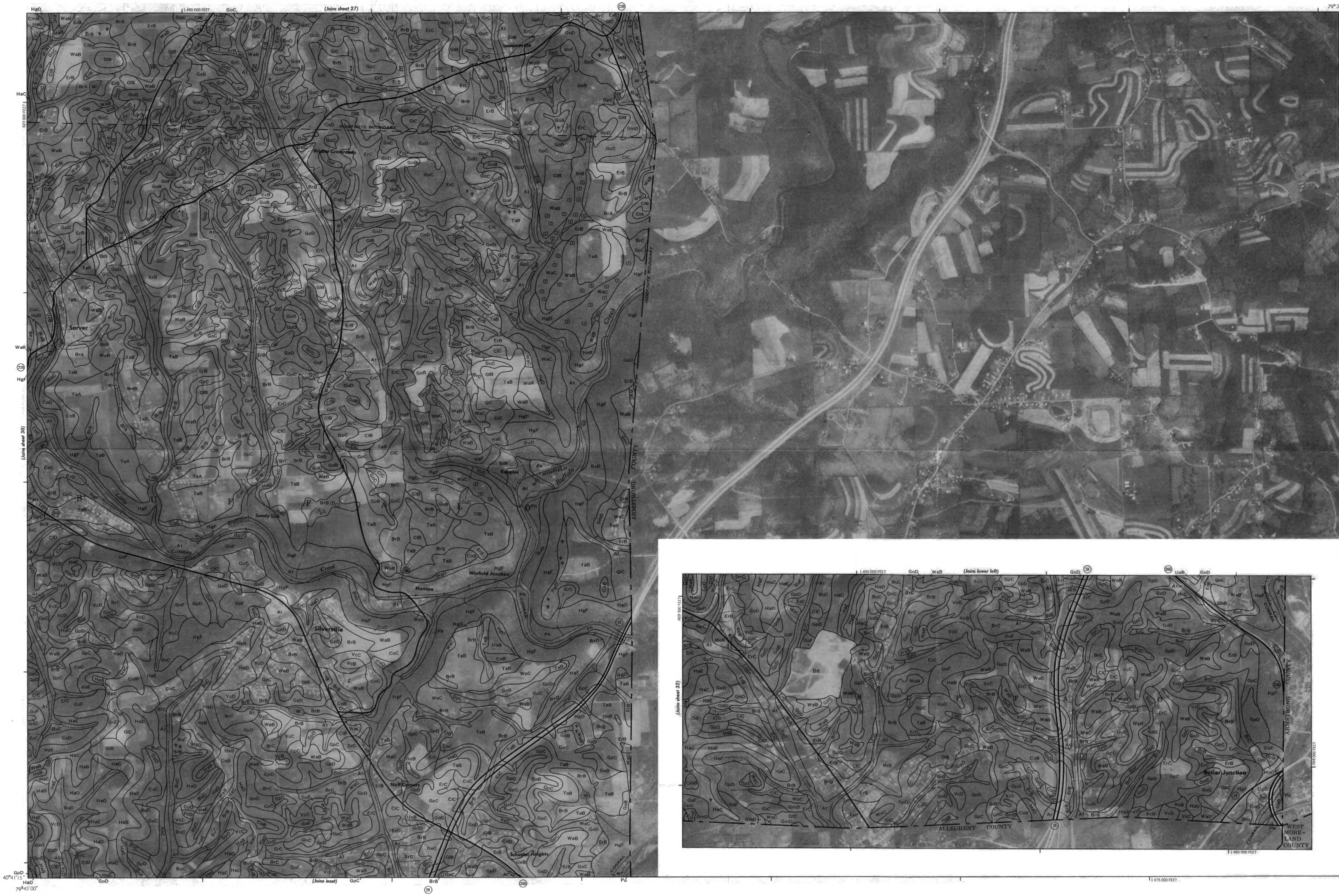
1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 30



1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

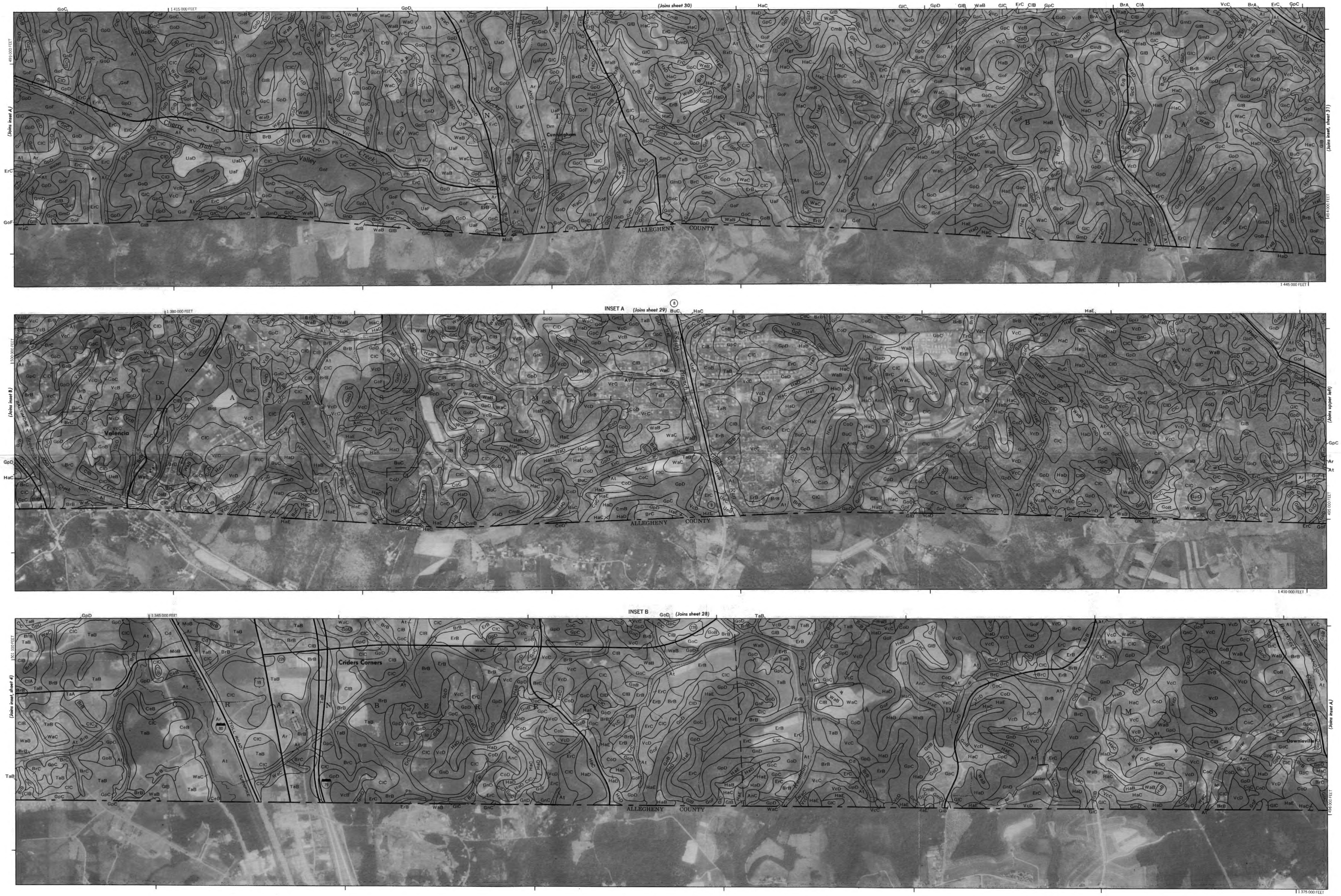
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF
BUTLER COUNTY, PENNSYLVANIA
SHEET NUMBER 32

32

N



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1 3/4 1/2 1/4 0 1 MILE
1 0.5 0 1 KILOMETER
SCALE 1:15 840

BUTLER COUNTY, PENNSYLVANIA NO. 32